SCIENTIFIC AMERICAN

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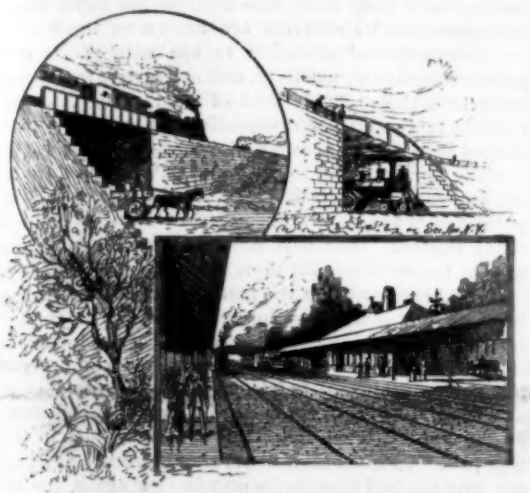
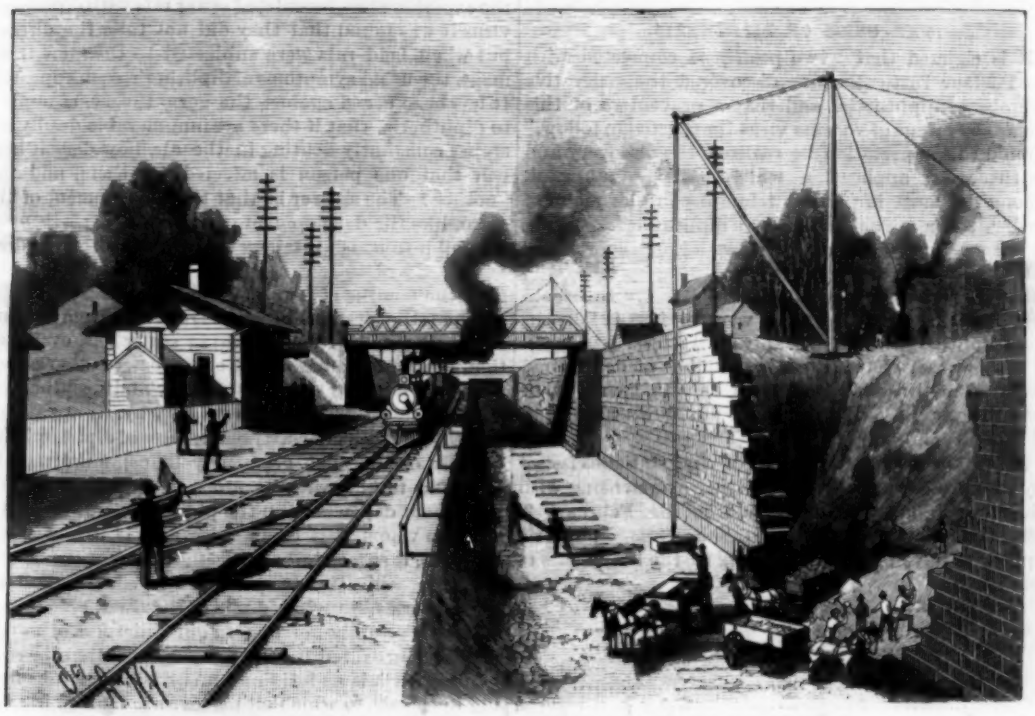


STANDARD BRIDGES AND NEW STATION AT LARCHMONT.

THE IMPROVEMENT OF THE RAILROAD APPROACHES OF NEW YORK.

It is probable that but few of the many thousand people who arrive or depart from the Grand Central Depot in this city realize how imperfectly provided the city of New York is with railroad approaches. The passenger systems of the New York Central, of the Harlem, and of the New Haven roads all come together at Mott Haven. At this point the Harlem River is crossed by an iron drawbridge. The bridge provides only two tracks, one for outgoing and one for incoming trains. Over this bridge all the through passenger trains of these three roads have to pass. At any moment it may have to be swung open to permit vessels to pass up or down the stream.

PORTCHESTER—LOOKING WEST FROM STATION.

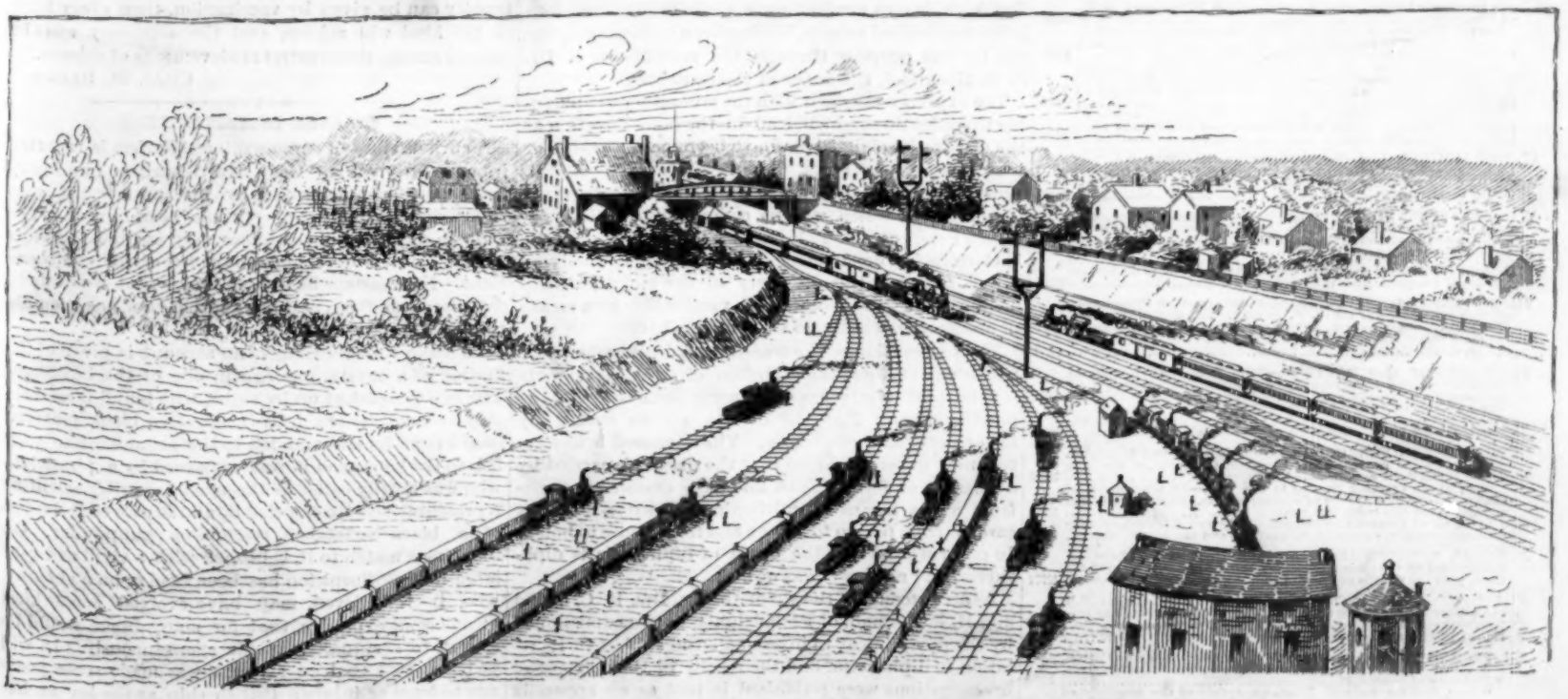


SINKING THE TRACKS AT MELROSE—LOOKING NORTH.

When the Harlem River ship canal shall have been completed, the case will be still worse, for the number of vessels going through the river will be greatly increased. It is not improbable that it will be necessary to construct a tunnel to supplant the bridge, and even were this done, it is far from certain that the depot facilities will be sufficient ten or twenty years hence.

The ideal railroad of the day has four tracks: two for through express and other rapid service, the other for freight and slower local trains. The New York, New Haven, and Hartford road, recognizing this fact, and having the insufficiency of the depot accommodations daily exhibited, have begun a series of operations designed to give them one of the model roads of America. At Mott Haven the first step has been taken in the purchase of a very large tract of land several acres in area for a freight yard. This is situated to the east of the line of Second Avenue, and the Second Avenue Elevated Railroad, curving to the east, runs through one corner. This territory abuts on the water, back of Randall's and Ward's Islands. A good depth of water exists along its very extensive pier line. This area is to be converted into a freight yard. The necessity for so large a space will be evident when it is known that as many as 1,500 freight cars have to be passed through the yard in a single day. Several docks with floats are provided for transshipping cars to the South or West. The floats are towed around the Battery to Jersey City or other points.

(*Continued on page* 134.)



N. Y. & N. H. R.R. FREIGHT YARD AT NEW ROCHELLE—LOOKING WEST.

Scientific American.

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NEW YORK, SATURDAY, MARCH 2, 1889.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 687.

For the Week Ending March 2, 1889.

Price 10 cents. For sale by all newsdealers.

THE DAFT ELECTRIC LOCOMOTIVE.

The trial of the Daft electric motor or locomotive is now in progress on the Ninth Avenue elevated track between Fourteenth Street and Fiftieth Street, a distance of one and four-tenths miles. The electric locomotive, with a train of four cars, switches in between the regular trains, and gaining on the schedule time of the steam trains, which is 13¼ miles per hour, the electric train often making a speed of 15 or more miles up a grade of 98 feet to a mile without apparent effort, the puffing of the steam cars being no part of the hard work with the electric locomotive. The highest speed yet attained when the track was unobstructed by other trains has been 30 miles per hour. This locomotive, weighing only ten tons, has drawn a train of eight cars up the grade of 98 feet to a mile below Fiftieth Street, at a speed of 7½ miles per hour.

The conductor is of copper rods on insulated pedestals, at a level with and a few inches outside of the timber guard rail, the return being one of the tracks. The completing of the electric circuit through the driving wheels and the track seems to increase the traction largely, as the wheels do not slip on starting, which otherwise would take place with any locomotive of such light weight.

The train has been running regularly during the past ten days, with the exception of an interruption of two days caused by the frequency of the regular trains during the strike.

The electric current is derived from four dynamos, driven by a Wright engine, 22 in. × 42 in., located in Fifteenth Street, near Tenth Avenue.

The indicated power of the engine for running the four dynamos for the track current and a dynamo for lighting was 240 horse power.

The electric facilities for handling the train seem to be perfect. Slowing and reversing with the slightest movement, for coupling the cars, is as much under the control as in a steam locomotive.

THE GERM OF DIPHTHERIA.

It is claimed that "two professors connected with the Pasteur Institute have discovered the generative microbe of diphtheria, and that a preventive of this disease by means of vaccine virus is expected to follow." Should this expectation be realized, the discovery and its successful application will certainly take rank among the most important triumphs in the realm of medical science. The prevalence of diphtheria, especially in the principal cities, and the very large proportion of fatal cases, is little dreamed of excepting by those who are giving special attention to the subject. In Brooklyn, N. Y., for instance, there were in 1888 984 deaths from diphtheria, which probably represented 3,000 cases. It is safe to say that if the same number of deaths had occurred in the same time from cholera, smallpox, or yellow fever, Brooklyn would be put down as a pest-ridden city indeed.

From four weekly statements of vital statistics issued by the Brooklyn Board of Health, commencing with the date January 12, 1889, and ending February 2, 1889, the following number of deaths from diphtheria appear to have taken place in six of the large cities of the world:

New York	182
Philadelphia	39
Boston	43
Brooklyn	124
London	92
Paris	118

It so happens that the new Hoagland Laboratory connected with the Long Island College Hospital, of Brooklyn, is now conducting a series of investigations in bacteriological science, having been especially equipped for this purpose through the munificence of Dr. C. N. Hoagland, the donor of the institution.

The experts connected with the laboratory are pursuing investigations which lead in the same direction as the discoveries claimed to have been made at the Pasteur Institute in Paris. The laboratory has sent to Europe for cultures of what are claimed to be diphtheria germs, which will be compared with those obtained here. Dr. G. T. Kemp, associate director of the bacteriological department of the laboratory, when consulted, said that the discovery of the real diphtheria microbe, and the adoption of vaccination as a means of prevention, was by no means improbable.

The prosecution of the search for a diphtheria germ, which has engaged the attention of scientific experts for the past few years, does away entirely with the popular theory that the disease can be caused by sewer gas or filth conditions. The advanced investigators now generally agree that the disease is carried by a microbe or germ. Filth and gases emanating therefrom are a means of cultivating the same, and may carry it from person to person and from house to house. In other words, that the cause of diphtheria is diphtheria, and not sewer gas or filth.

As an outcome of the germ theory, Drs. H. C. Wood and H. F. Formad, of Philadelphia, were commissioned by the government to investigate the subject in its relation to diphtheria, and the results of their extended investigations were published in 1882, as an appendix to the report of the National Board of Health. They obtained specimens of micrococci (germs nearly round in shape) from persons suffering from diphtheria and representing the disease in various stages. Rabbits, Guinea pigs, and rats were inoculated with the micrococci, and the result was that they soon manifested symptoms of diphtheria—fever, formation of membrane, paralysis, and, finally, death. Later investigations demonstrated the fact that there is still an undiscovered germ, the means for investigating which were not perfected when Drs. Wood and Formad made their inquiries in 1882. The publication of Loeffler's treatise on the germ of diphtheria, which appeared in 1884, and which fills seventy pages of the quarto volume of the "Kaiserlichen Gesundheitsamte," worked a very great advance in the search for the true germ of diphtheria. Strange as it may seem, this treatise has never been translated, but its contents are known to those who are giving special attention to the subject. It describes the minute, masterly, and exhaustive investigations into this difficult field of bacteriology, which resulted in the author designating the bacillus (a rod-shaped germ) as the genuine diphtheria microbe.

If the work referred to in the dispatch from Paris is the same as that done by Profs. Roud and Yersin, and published in the last number of the "Annales de l'Institut Pasteur," then it is merely a research confirmatory of the work already done by Loeffler.

Having assumed that the true germ of diphtheria has been, or that it will eventually be, discovered, the interesting question presents itself whether the introduction of the virus into the human system can prevent the person so inoculated from taking the disease. A number of scientific gentlemen who have been consulted on this point express themselves as having faith in the new process, while others claim that inasmuch as a person who has had diphtheria may have it again, the introduction of diphtheria virus into the system by means of vaccination can give no greater immunity from future attacks. On this point it may be said that when the experimenters inoculated sewer rats with diphtheria virus it was found that they did not take the disease, but when field rats were subjected to the same treatment, the usual symptoms of diphtheria soon appeared. It has been urged against the germ theory, as applied to diphtheria, that if there are innumerable deadly microbes constantly floating in the air, how does it happen that one person is affected by them, and not another? The answer is, that the development of the germ, like the development of the seed, depends upon the soil into which it falls. Of thirty healthy children examined by Loeffler, the diphtheria bacillus was taken from the mouths of four of them.

When the system becomes reduced from various causes, it may be from breathing sewer gas, over-exertion, improper nourishment, or neglect, or other causes, then the microbe develops rapidly and diphtheria is the final result. This may explain why, in apparently healthy and well guarded homes, cases of diphtheria frequently occur. The germ may be communicated by one child talking with another on the street. Its development depends upon the physical condition of the child to whom it is communicated. If it is well and vigorous, it successfully baffles the effects of the dangerous germ, while if other conditions exist, the germ acts like a spark falling into a pile of shavings.

It will certainly not add to our quietness of mind if it be demonstrated beyond peradventure that the cause of diphtheria is an insidious, an invisible microbe floating in the air, to which all persons are more or less subject. But if coupled with this demonstration it can be shown, as a result of recent investigations, that immunity can be given by vaccination, then every lover of his kind will rejoice, and the discovery will be ranked among the greatest achievements of science.

CHAS. D. BAKER.

STRANGE INCENDIARISM.

A curious story of supposed incendiarism is reported from Pennsylvania. Near Harrisburg a number of barns have been destroyed by fire, until from $20,000 to $30,000 worth of property has been burned. The farmers naturally have become very excited, the more so as a mystery overhangs the cause of the conflagrations. No footsteps have been found that would indicate the incendiary, and no tangible clew has been obtained.

To make it still stranger, an account is given of the finding of a mysterious egg in one of the buildings. The egg was picked up by a girl, who found it remarkably heavy. As she held it up, some black material issued from its end and fell to the ground. She took it into the house and it was examined by a physician, who was hastily called as the most accessible scientific representative. He emptied it, and it proved to be full of a black substance resembling gunpowder. On touching a match to it, it burned with a vivid and very large flame. Suspicion has been fixed upon a chemist, who, it is believed, may have evolved some kind of an occult explosive, that for many hours would lie at rest, to eventually explode spontaneously. It will be recollected that an attempt was made some years ago to burn or injure a British ship as she lay at her pier in this city. The agent used was probably in the

last named case, an ethereal or carbon disulphide solution of phosphorus. Such solutions, as they evaporate, leave a thin pellicle of phosphorus that catches fire spontaneously, usually without doing much harm. Spontaneously inflammable phosphureted hydrogen is easily made by boiling phosphorus and caustic potash or lime with water. It is quite conceivable that some mixture which would slowly evolve such a gas might be made, which, inclosed in a thin vessel, sooner or later would burst the inclosure and, issuing into the air, would ignite.

For the sake of the peaceful farmers of York County, it is to be hoped that the resources of chemistry have not been lowered so as to contribute to their injury. Like many other things, it is easier to write about them than to execute them, as practical difficulty attends every step in the development of similar classes of experiment. If the York County hens were to lay eggs containing phosphorus instead of sulphur, then a decayed egg might be expected to give off spontaneously inflammable phosphureted hydrogen, instead of the regular sulphureted hydrogen that now does no injury, save by its odor and its power of blackening any silver that comes in contact with it. This would make the hen an involuntary incendiary.

Copra or Cocoanut Meat.

A correspondent of *Engineering* describes a visit to a little islet in the Pacific as follows:

Washington Island belongs to Messrs. Greig, Bicknell & Co., of Honolulu, and is under British protection. Its main produce is copra, or the inside of cocoanuts. There are on the island, besides Mr. Briggs, nineteen men, twenty women, and some half a dozen children, all natives of Peru, an island in the Kingsmill group, further to the west—whence they are brought on a three years' engagement.

The method of preparing the copra is as follows:

The men collect the nuts, a certain area being assigned in which they must work during the different days. They are not allowed to pick from the trees, but must confine themselves to taking the nuts from the ground when they fall. This is in order to prevent waste, as a man getting up a cocoanut tree might cut down unripe fruit with the others, which unripe nuts would be wasted. Immediately the fallen fruit is picked up, the husks are stripped off, except one small strip used for carrying the nuts, which are thus conveyed to the end of the tramways and so to the village. Here they are taken charge of by the women, cracked in two, and set out to dry with the shells uppermost. After a couple of days the inside shrinks, and can be easily picked out, when it is broken up, dried, and stored ready for removal by a schooner which visits the island every six months. The pay of the workers is $5 a month, the first year being paid in money and the second and third in what they call cloth, that is, prints and bright-colored stuff. Seeing that the natives feed themselves, and that the cloth is valued at 25 cents (about) a yard, its original cost being about four, it must be allowed that the labor does not cost much. The earnings of the workpeople vary somewhat, as the amount mentioned is contingent on each pair (a man and his wife) bringing in and preparing 4,000 nuts a month, an increase in this number being paid accordingly. The value of a ton of copra delivered at San Francisco is about $60, and is equivalent to about 4,300 cocoanuts. The amount gathered last year amounted to about 180 tons, so taking the salaries of the manager and natives at $1,700 (the manager gets $60 a month and all found), the profit per annum should be about $9,000 = £1,800. The schooner that takes the copra pays her own way by bringing down cloth to trade.

The soil of the island seemed to be very fertile, though based on a foundation of coral. In the year 1886 it rained 79 days, and there is a fresh water lagoon on the island which never dries. Cocoanuts, bananas, pineapples, melons, and other tropical fruits grow luxuriantly. There are about 2,000 tons of guano on the island, but it is said that it does not pay for removal. Cocks and hens run wild about the woods; they were originally introduced here, but now take care of themselves, and are shot when required for table. We shot a few for our own use and found them pretty wild.

Mexican Railways.

The engineers of the Mexican Southern Railway have laid out the line as far as Tecomavaco, 58¼ miles south of Tehuacan, and the preliminary surveys have been carried as far as Puebla, where the new line will connect with the Inter-Oceanic and Mexico and Vera Cruz railways. The contractors hope to begin active construction early in 1889, and they will complete 142½ miles in eighteen months from the date of starting work. This will carry the line to Tecomavaco. The section beyond, to Oaxaca, will be carried on during the succeeding twelve months. The new line will carry the American and Mexican railway systems some 300 miles further south, and will shorten the time from Europe and New York to South American and Pacific ports from a week to ten days in the former, and four to five days in the latter case.

The Sparrow Pest.

Mr. J. H. Sherman, in a recent letter to the New York *Tribune*, presents a strong indictment against the English sparrow, the reasons why these birds should be exterminated, and how to do it. He says:

Since importation, they have multiplied at the annual rate of five or six broods of from four to six each to the pair, and spread over more than half of the United States and Territories, with a large portion of Canada, and are covering the remainder at the present (but increasing) rate of more than 500,000 square miles a year, and are everywhere driving out both insectivorous and song birds. In the spring, sparrows bite off or pull up tender garden plants as soon as they come up, and eat out germs from fruit buds of trees, vines, and small fruit plants. Such germs as are not completely destroyed are often mutilated and so form imperfect fruit, which falls a ready prey to the increased swarms of insects. Later in the season they attack the choicest growing vegetables and early ripening fruits, and destroy grapes and peck into mellowing apples and pears in the fall.

Their depredations upon farm crops are becoming more serious, in the entailment of pecuniary loss, than those upon horticultural products. For breeding haunts, and winter food and shelter, they throng by preference into towns and cities. Thence, near harvest time, they flock out to farms round about, alighting upon fields of grain of all sorts, eating the kernels before they are hardened, and eating and wasting those that are ripe. Standing upon grain stalks, swaying to and fro and flapping their wings to keep their balance, they scatter much upon the ground. Thus whole fields are ruined. Shocks and stacks are also covered with them till all exposed heads are left without a kernel. In a visitation from New Haven such crowds collected upon neighboring wheat shocks that the owner killed eighty-nine by one discharge of his double-barreled shotgun. Corn fields do not escape their destructive work—the ends of green ears being torn open and the grain eaten or so mutilated as to ferment and decay.

They disfigure public and private buildings, and ornamental trees and shrubbery with nests and excrements. Not only do cornices, gables, and architectural ornaments suffer, but roofs and water gutters receive their pollutions.

They congregate in vine coverings of churches and other edifices. The luxurious ivy formerly covering portions of the Smithsonian building, at Washington, was thus totally destroyed. The sexton of St. John's Church, at Providence, R. I., took 970 eggs and two cartloads of nests at one time from the ivy upon the walls of that church.

The infliction becomes no more tolerable to us because England herself, and all countries to which Englishmen have migrated with their pet pest, are suffering as badly as America. There is but one worst pest known in the wide world, viz., the rabbit that is ravaging Australia and its neighboring islands. This also was introduced from England a few years after the sparrow came here. The plague of rabbits seems remediless, but that of sparrows is not. These birds are peculiarly gregarious, and gather about human habitations. First filling cities and villages, they next go to farms, and to woods and lonely places only as forced by overcrowding, whence they return if room is again made for them. Hence, they are very accessible to the fowler. Gunning sportsmen killed thousands of them in Ithaca last winter, bringing marked relief in early spring, and an accession of useful birds from forest recesses. But soon, between breeding and collecting from outside, sparrows again nearly monopolized the town. A sweeping destruction, persevered in for two or three years, would free both town and surrounding regions from their presence. Similar concerted action in all cities and villages, with sufficient co-operation by farmers to drive them from their home premises, with a little shotgun watchfulness for estrays that might subsequently appear, would insure their extermination from the country.

To this end there is one effective means, and probably only one—and that is poison. To discover the best method of its administration has been the object of much experimenting under the direction of the United States Agricultural Department, described in pages 423 to 426 of the Commissioner's Report for 1887. The resulting recommendation is feeding sparrows with wheat prepared according to directions to be gathered from the report, but which the commissioner, in reply to a letter of inquiry, furnished more clearly in the following formula: Dissolve arseniate of soda in warm water, at the rate of an ounce to a pint; pour this upon as much wheat as it will cover (in a vessel which can be closed so as to prevent evaporation) and allow it to soak at least twenty-four hours. Dry the wheat so prepared and it is ready for use. Three kernels of this will kill. Winter is the best time for operations. Other birds are then absent and sparrows are hungry, alighting in flocks in the streets after passing teams and along railroad tracks, where grain is scattered from wagons and cars. Here poisoned wheat may be administered with wholesale destruction to them and little danger of harm to anything else. If an occasional pigeon or chicken that has no business abroad should suffer, it is comparatively of little consequence. If the great evil is to be abated at all, it must only be required that it be done with the least practicable injury and inconvenience.

Going to Law.

Law has been called a luxury, but surely more with a view to its cost than to the pleasure men can derive from recourse to it. Save in very exceptional cases—such as the settlement of a great question of principle in which whole classes may be involved, and in which the parties to the case are really representative individuals, through which circumstance personal bias or animosity is largely removed from them—law is the resort of the foolish and imprudent. In nine cases out of ten of mere litigation, narrow-mindedness and ill-temper have much to do with it, and, once in, the whole machinery seems contrived, by a hundred little artifices, to fan the flame rather than to allay it. We gratefully remember, as a relief to the depressing story of what we may call legal hunger, the case of Mr. Thomas Brassey, who, in all his long experience as a contractor, engaged in most extensive and complicated transactions, only once allowed himself to be led into a lawsuit, and that, he tells us, was in the case of a Spanish railway in which, unfortunately, he had a partner who would not rest satisfied without recourse to law on some point in dispute. Mr. Brassey declared that he would not enter on another lawsuit in any circumstances whatever; his conviction being that, even if you won your case, it would not repay you for the loss of temper and of peace of mind, the strength taken from your business, and the general disarrangement in your affairs consequent on such a process.

Sir Walter Scott, who knew well what going to law means, being himself a lawyer, has embodied for us the passion for law which grows with what it feeds on in the person of Peter Peebles; and Charles Dickens in nothing showed more humor and more sympathy than in his most graphic pictures of the characters who, like ghosts, haunted the old Chancery Courts in London. And George Eliot in the "Mill on the Floss" well illustrates the absorbing power of the law mania, even on minds otherwise so strong and healthy as that of Mr. Tulliver:

"'What I want, you know,' said Mr. Tulliver; 'what I want is to give Tom a good eddication; an eddication as'll be a bread for him. That was what I was thinking of when I gave notice for him to leave the academy at Lady-day. I mean to put him to a downright good school at midsummer. The two years at th' academy 'ud ha' done well enough, if I'd meant to make a miller and farmer of him; for he's had a fine sight more schoolin' nor I ever got; all the learnin' *my* father ever paid for was a bit o' birch at one end and the alphabet at the other. But I should like Tom to be a bit of a scholard, so as he might be up to the tricks o' these fellows as talk fine and write with a flourish. It 'ud be a help to me with these lawsuits, and arbitrations, and things. I wouldn't make a downright lawwer o' the lad—I should be sorry for him to be a raskil—but a sort o' engineer or a surveyor, or an auctioneer and vallyer, like Riley; or one o' them smartish businesses as are all profits and no outlay, only for a big watch chain and a high stool. They're pretty nigh all one, and they're not far off being even with the law, *I* believe. For Riley looks Lawyer Wakem i' the face as hard as one cat looks another. *He's* none frightened at him.'"—*Christian Union.*

Ninety-three Millions of Money.

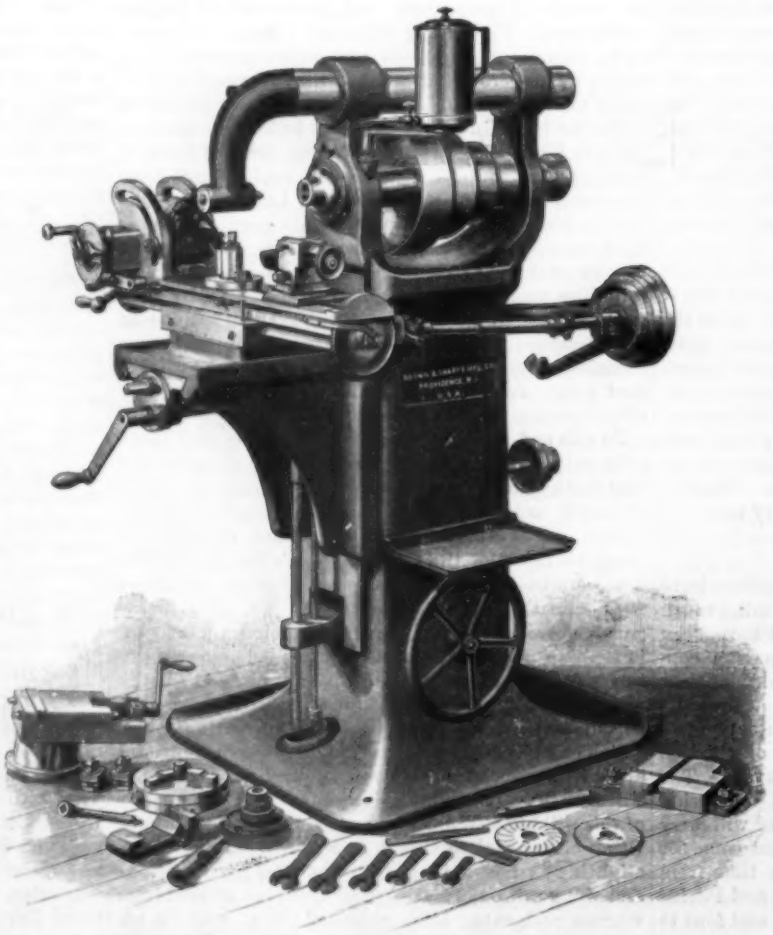
Was he insured? is a question we ask almost as naturally after a man's death, as after a fire; because it is coming to be recognized as much a matter of business prudence to insure one's life as it is to insure against loss by fire. There are many good business men in the world, and it might be a matter of wonder where they all insured their lives did not the annual reports of the companies call attention to the immense business done by some of them. Here is the New York Life, for example, whose report appears in another column, with an annual income of twenty-five million dollars, with assets to the amount of ninety-three millions, and carrying nearly four hundred and twenty millions of insurance on its books. It paid over ten millions to policy-holders in 1888, and wrote a hundred and twenty-five millions of new insurance. Its success is the result of superior management, and is well deserved.

IN a review of our new navy, London *Engineering* says: "In closing these details, we may add that Great Britain has now ten war vessels of 3,000 tons and upward with a minimum speed of 19 knots per hour, the United States eight, France five, Spain three, Japan two, and Russia one. The United States accordingly now claim that, in the important matter of high speed war ships, they rank second, and are not far behind Great Britain. The Americans are, in fact, going in for high-speed cruisers.

AN IMPROVED UNIVERSAL MILLING MACHINE.

The machine shown in the accompanying illustration is not only of most excellent workmanship itself in all its details, but it is capable of being used for such a wide variety of work that all machinists familiar with its capabilities appreciate the justness of styling it a "universal" miller. It does the work of the planer or shaper, turns, bores, and drills, flutes taps and reamers, and cuts gears and spirals—doing everything with entire accuracy and generally in less time than it could otherwise be done, while it requires but the minimum of personal supervision, when once started on a job. The machine is largely used in the establishments of machine tool builders, technical schools, government arsenals, gun and testing machine works, fine jewelry factories, and tool rooms of almost every description, and it is not asserting too much to claim that it is largely due to the use of such machines that American machinery and tools now occupy so high a position in comparison with those employed in any other part of the world.

The distinctive features of the machine were first patented by Joseph R. Brown, in 1865, and it has since been widely copied, in its details and in its entirety, by numerous imitators. It has all the movements of a plain machine, while the table is fed automatically at an angle to the axis of the spindle, and the spiral head is so made and connected with the feed screw that a positive rotary movement may be given to the work. The wear of the main spindle is taken up by longitudinal movement, and the end thrust is taken by a collar. The cone has four steps for a three-inch belt. The knee can be moved vertically fifteen inches, and the saddle holding the spiral bed can be moved six inches in a direction parallel with the axis of the main spindle. The table is twenty-eight inches long and five inches wide, and has an automatic feed of seventeen inches. A series of graduations shows in degrees the angle to the axis of the spindle at which the table is fed, and index dials show the vertical and horizontal movements of the knee in thousandths of an inch. The spiral head has indexing mechanism by which the periphery of a piece of work may be divided into equal parts; and the velocity of the rotary movement of its spindle, or of the work, relative to the speed of the feed screw, is regulated by change gears at the end of the bed. The front end of the spindle is threaded to receive a chuck. A piece eight inches in diameter and fourteen inches in length can be swung between the spiral head and the foot stock. The frame is hollow, and fitted as a closet to hold the small parts that accompany the machine. The countershaft is usually run at about 110 turns per minute. The total weight of the machine is about 1,800 pounds, and the floor space required, measured over the extreme projections and points of travel of the various parts, is 55 by 50 inches. The machine is also made with an overhanging arm to support the outer end of the arbor carrying the cutter.



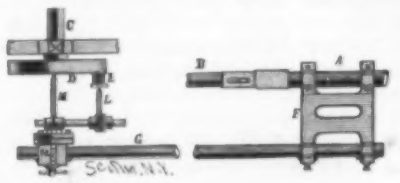
BROWN & SHARPE'S NO. 1 UNIVERSAL MILLING MACHINE.

A New Dye from Seaweed.

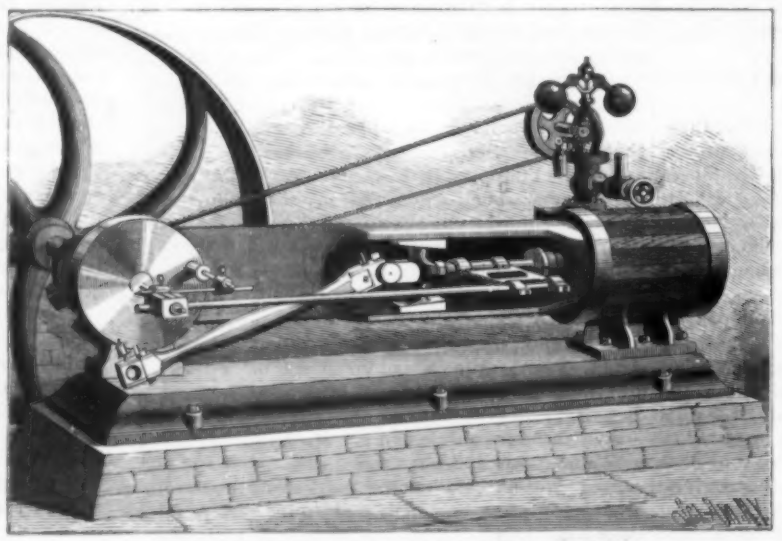
Formerly iodine, bromine, magnesia, and potash salts were the chief products of seaweed, which was also used, when more or less decomposed, as manure on land adjoining the sea coast (it yields upward of 2 per cent of ammonia). Some varieties were collected as articles of food in Scotland, Ireland, and Norway, etc. (the species of the genus *Ulva*), and the large species of *Laminaria*, especially *L. saccharina*, can be made to yield mannite. Of late years seaweed has been made into charcoal, and into a material for whip handles, and still more recently the curious substance algin has been produced from it, and is already in use as a stratum for photographic films, and for other purposes. From the substance algin, just mentioned, an acid called alginic acid has been produced, and by acting upon the latter with nitric acid a new light-colored dye, which is insoluble in water, but dissolves in alkalies, yielding a brown solution, has quite recently been discovered. The ammoniacal solution of this new product dyes cotton a fine Bismarck brown, which is not removed by soap, and is said to be not only equal to aniline dyes of the same description, but to excel many of them. A curious feature of this new product is that, contrary to what is observed with aniline dyes, it will dye cotton but not wool, and that its acid solutions will not act as dyes at all.

AN INSTRUMENT TO TEST ENGINE CRANK SHAFTS.

A means of testing and adjusting the crank shafts of engines forms the subject of a patent issued to Mr. John Paterson, of No. 56 John Street, Victoria, B. C., and is illustrated herewith, the small figure showing a plan view of the device. A small frame, F, preferably



of brass, is connected with the working part of the piston rod, A, B being the connecting rod and C the crank shaft, the crank, having been released from the crank pin, E, on the crank disk. A rod, bar, or tube, G, is adjustably fitted in the other end of the frame, F, to lie in the same horizontal plane as the piston rod, and carries a sliding adjustable head, H, fitted on the top with a small level. In this head rotates a hub carrying a radial arm having an adjustable pointer, L, while a pointer, M, is also fitted in the end of the hub. If the outside of the crank-pin is flat, or has been bruised, a small hole is drilled in the center. The frame being connected with the piston rod, the head, H, is set perfectly level, by means of the level in its top, and the pointer, M, centered on the crank shaft, which is then turned around to adjust the pointer, L, to the center of the crank-pin. This pin is then gauged at the outward and inward centers of the crank thereon, by which it will be perceived whether the shaft is rectangular with the line of the cylinder, and, by turning the crank-pin to the top and then to the bottom, following with the pointer, it will be shown whether the shaft is level or not, saving the labor and time ordinarily required to take out the piston, center the cylinder, and apply a line and level.



PATERSON'S STEAM ENGINE CRANK SHAFT TESTER.

Recent Telephonic Investigations.

Electricians have so often had their preconceived ideas rudely shaken by the results of rigid experiment that the time for dogged persistence in past errors has almost passed, and new truths are assimilated with ease. Among such cherished ideas is the alleged infinitesimal strength of the ordinary telephonic current, a conception arising, no doubt, from the alternating nature of the telephonic current and the difficulty of constructing suitable instruments for its measurement. In referring to this subject in a lecture before the Boston Society of Arts, on work done at the Massachusetts Institute of Technology, Prof. Ch. R. Cross drew attention to the faulty construction of instruments intended for such investigations. Such instruments failed largely through the use of metal in close inductive proximity to the coil carrying the telephonic current to be measured, which gave rise to induced currents that weakened the original. Having removed this source of error by the construction of a galvanometer without metal, Prof. Cross finds that the average telephone current is far greater than is popularly supposed. The average current strength was not far from 0·5 of a milli-ampere, while an Edison lamp takes one-half ampere, or only 1,000 times as much; and in the loud-speaking telephone it was 20 milli-amperes—an amount sufficient to give one a good shock. Lastly, it was found possible to transmit speech distinctly by a current which could not be detected by the most sensitive instruments. These currents, from 0·5 to 20 milli-amperes, were produced by speaking or sounding a loud note from an organ pipe into the transmitter. These results were also confirmed by experiments on actual working lines. Much more interesting, however, were the experiments on the New York long-distance line for the purpose of estimating the losses. For this work granulated carbon Hunning transmitters were used. In talking to New York practically all the current passing into the line traversed the instrument and was measured. The operator in New York then talked over the line, and the current, less the loss, was found to be 0·01 to 0·02 milli-ampere, while when entering the instrument before passing over the line it was 10 to 20 milli-amperes, giving a loss of over 99 per cent. The actual working current was, therefore, exceeding small—in fact, absolutely much smaller than on the city lines. There should have been no unusual losses, as the day was perfectly clear. That the service over the long-distance lines should be so good is evidently due to the use of a metallic circuit of low resistance and retardation, and the sounds were clearer and more easily understood than on the city lines. The value of the current as determined by the material and shape of electrodes was also studied, and carbon, platinum, iron, and copper employed in various combinations. Carbon with carbon gave a large range of variation, platinum on platinum a greater range, which fell off suddenly. With iron the curve was low. In altering the electrodes a curious point was noticed, for it makes considerable difference which is the anvil electrode. It was found that the anvil is the governing electrode, for, with carbon as the anvil, the curve is like that of carbon for both, although the other may be of iron.—*Electrical World.*

Quick Repairing.

The steamship Monkseaton, of Newcastle, which lost three blades of her propeller when on a voyage from Liverpool to New York, was placed on the pontoon dock belonging to the Wallsend Pontoon Company, Limited, with 2,000 tons of cargo on board, and her stern raised out of the water sufficiently high to allow the broken propeller to be unshipped and a new one fitted in its place. The operation of tipping the vessel took one and a half hours, and the whole time occupied in raising her and changing the propellers was only twenty-three hours. The Monkseaton is a vessel of 2,900 tons gross tonnage, and the saving of time and money secured by her not having to discharge her cargo must have been very considerable.

A LUGGAGE CARRIER FOR BICYCLES.

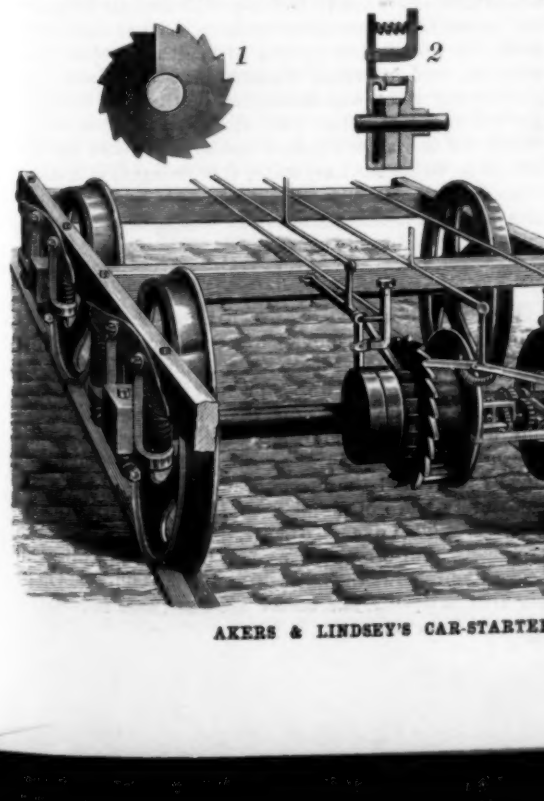
A simple device for attachment to the head of a bicycle, to facilitate the carrying of bundles or packages, and which will form a convenient hand carrier when detached, is illustrated herewith, and has been patented

CREDLEBAUGH'S LUGGAGE CARRIER FOR BICYCLES.

by Mr. Henry S. Credlebaugh, of New Carlisle, Ohio. It is made of a stout spring-wire body, the side arms and cross bar of which are formed of a single piece of wire, adapted to be sprung in place upon the head and handle bars of the machine, as shown in the sectional view. The outer ends of the arms have eyes, in which are held the cross bar of a depending or bracket portion, also formed of a single piece of wire, and carrying a handle block having a notch adapted to fit upon the flat arm of the brake spoon, preventing lateral movement of the carrier, and holding it steadily. The construction of the carrier admits of simple modifications, to adapt it to different styles of bicycles.

AN IMPROVED CAR-STARTER.

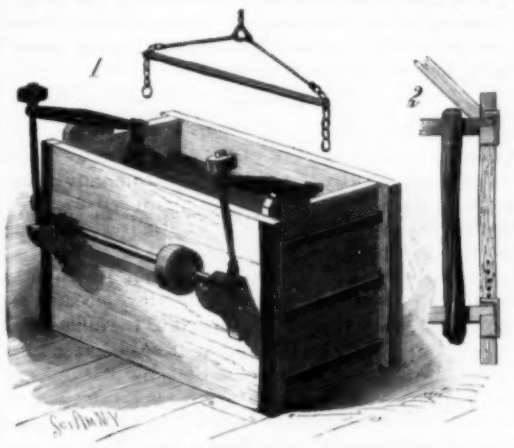
A device adapted for use with all kinds of cars and vehicles, and designed to store power when not required for their propulsion, as in going down hill, and at other times, and give it out when most needed, as in ascending grades, etc., is illustrated herewith, and has been patented by Messrs. William P. Akers and John C. Lindsey, Jr., of Jacksborough, Texas. On one of the car axles is loosely held a sleeve having a ratchet wheel engaged by a pawl fulcrumed to the car, and pivotally connected by a link to a lever operated by the driver or conductor. On the front face of the ratchet wheel is a spiral cam, as shown in Fig. 1, on which operates a block held to slide transversely in a wheel secured to the axle of the car, the outer end of the block having a shoulder engaged by an annular flange formed on a lever fulcrumed on a bracket attached to the car, a spring holding the block in its innermost position, and a rod or rope, secured to the lever, extending to a brake-staff on the car. To the other end of the sleeve is secured a gear wheel meshing into a gear wheel on a shaft rotating in suitable bearings on the inner face of a disk rotating loosely on the sleeve, the disk having a ratchet wheel with its bearing on the sleeve, while between this ratchet wheel and the disk is held a coiled spring, fastened by one end to the disk and by its other end to the sleeve. This ratchet wheel is engaged by a pawl pivotally connected with an arm fulcrumed on the car, a semicircular arm being pivoted on the pawl, which passes through another arm connected by a link to a lever fulcrumed on the car, whereby the operator may disengage the pawl from the ratchet wheel when desired. Figs. 2 and 3 illustrate details of the construction, which provide for the winding up of the coiled spring, by the revolutions of the car axle, as the car goes either backward or forward, such work being always under the immediate control of the conductor or brakeman, who can also at any time cause the spring to give out its stored power to revolve the axle. This device may be fitted to a number of axles, or be duplicated, the power stored in the different springs to be utilized successively or simultaneously, as may be desired.



AKERS & LINDSEY'S CAR-STARTER.

AN IMPROVED DYEING MACHINE

A machine designed to thoroughly dye yarns, etc., without breaking or matting them, is illustrated herewith, and has been patented by Mr. Thomas Wolstenholme, of No. 730 Walnut Street, Camden, N. J. The tank containing the dyestuff has a driving shaft at one side, from each end of which extends a crank arm pivotally connected with beams mounted to swing on top of the tank, the inner ends of the beams supporting a yarnstick frame in the tank in such manner that the frame can be easily attached to or detached from the beams. The frame is also adapted to be connected to a support held on a tackle, which may be mounted to travel in a beam extending above the tank, and whereby the operator can raise or lower the frame. The frame is preferably rectangular in shape, and has at its upper end opposite longitudinal beams supporting yarnsticks, which rest in suitable notches, beams being also held to slide vertically in the lower part of the frame and support yarnsticks, the latter beams being held adjustably by pins passed through apertures in the side beams, as shown in Fig. 2. The frame, filled with strands of yarn, is moved over and let down into the tank, when it is connected with the beams, and the driving shaft imparts to it an up and down swinging motion, whereby all parts of the yarn are thoroughly dyed, the yarn being held on



WOLSTENHOLME'S DYEING MACHINE.

the locked sticks in an even position, which prevents breaking and matting of the strands.

Thirteen-mile Guns.

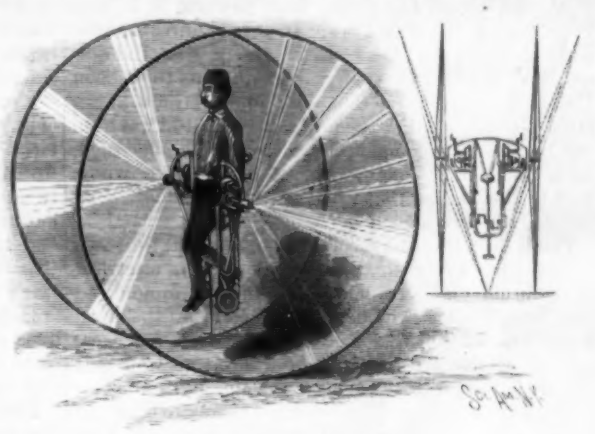
Two monster Russian guns were sent recently to Sebastopol, says the London *Times*, for the purpose of being placed in the new ironclad Sinope, and although some of the details must be inaccurate, the official description is too interesting to be ignored. They are 12 inch pieces, weighing 50 tons, and throwing projectiles of nearly half a ton. The powder charge is 270 pounds, and the initial velocity 3,000 meters, while the distance of the cannons' ranges is said to be 20 versts, or over 13 miles. As a consequence, the fire of the guns can only be directed by the map, the object fired at being out of sight. Two men, however, suffice for each gun, as they are worked by hydraulic machinery.

Tidal Action in the Flow of a Gas Well.

A strange phenomenon is reported in connection with the natural gas supply at Montpelier, Ind. For six hours, it is said, the flow declines in pressure to a minimum, then rising for six hours to a maximum throughout the day. The movement is constant as the ocean tides; but whether or not the same influences are the cause is a matter of conjecture, as no comparisons of time and tide, nor the exact variation in pressure, have as yet been made. The amount of variation as yet known is derived from the operation of the main valve, which is nearly closed at the maximum and wide open at the minimum, in order to preserve a constant supply pressure.

AN IMPROVED VELOCIPEDE.

The accompanying illustration represents a vehicle with means for inclining the wheels at the pleasure of the rider, so that the lower parts of each wheel may be

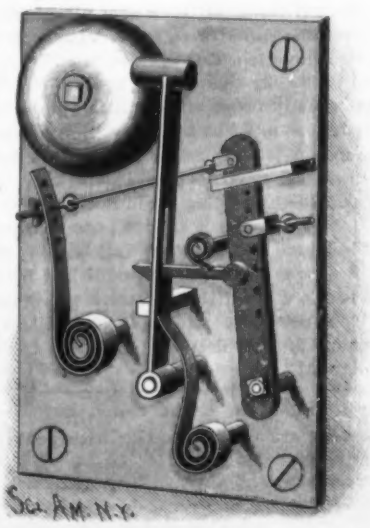


BOWEN'S VELOCIPEDE.

moved inward to run on a narrow path, the machine also having a brake and means for steering. It has been patented by Mr. Richard E. Bowen, of St. James City, Lee County, Fla. The frame has a bow top, with loop brackets extending downward, from which are converging arms, to a bottom cross piece of which is fixed a straight bar also fixed to the under side of the seat. A rod bent to form a double reverse crank treadle is journaled in the sides of the frame, each end of the rod having a sprocket wheel with chains for rotating a shaft journaled in a sleeve bearing and sliding block of the frame, and also carrying a friction wheel. The main wheels are fixed on two short shafts connected by a universal joint, and journaled in sliding blocks, said shafts each carrying a friction wheel, operated by the friction wheel connected with the crank treadle. By screwing down a threaded rod upon the sliding block, the main wheels are inclined as shown in the sectional view, the wheels returning to their normal position when the screws are raised. The machine is steered by raising one of the friction wheels out of contact with its companion wheel on one side of the machine.

AN IMPROVED SIGNAL BELL.

The accompanying illustration represents an easily adjustable apparatus for striking a signal bell, patented by Mr. Engelbrecht Olsen, of Walkerville, Montana Ter. The bell is secured to a post on the base plate to which the parts are attached, the striking lever being pivoted to the base plate so that its movement will be controlled by a stop and a pressure spring. Just above its pivoted end the striking lever has a slot in which works a trip lever, with a hooked head, this trip lever being held in engagement with the striking lever by a spring, and being itself secured to a lever whose lower end is pivoted to the base plate and whose upper end works in a keeper. A tension rod is adjustably attached to the free end of the latter lever, whereby the weight of the pull cord may be balanced when the device is used for mines and the rope runs down the shaft. The pull cord may be connected directly with the lever to which the trip lever is secured, when the rope runs horizontally, as in case of its use on railroad cars, or such connection may be made by means of an elbow lever placed at the mouth of a shaft, the two levers having perforations set to the same scale for regulating the pull of the tension rod.



OLSEN'S SIGNAL BELL FOR MINES, ETC.

Electrical Consolidations.

The incorporation, under the laws of New Jersey, of the Edison General Electric Company, with a capital stock of $12,000,000, marks the consummation of the negotiations which were the basis of the rumors and newspaper gossip current a few weeks ago.

The new company takes over the plant and business of the several Edison manufacturing companies, namely: The Edison Machine Works, Schenectady, N. Y., the Edison Lamp Co., East Newark, N. J., and Bergmann & Co., New York. It also acquires the property and business of the parent organization, the Edison Electric Light Company, and supplants the Edison United Manufacturing Company in the trade in isolated plants. A large amount of new capital has been put into the new company, furnished, it is understood, by a syndicate through Mr. Henry Villard, whose part in the transaction attracted so much notice by the daily press a month ago.

The Edison General Electric Company will thus own and manage the entire Edison interests in electrical distribution and lighting. It is further announced that branch offices will be established in all the leading cities, and that the erection and operation of local central station lighting plants will be a prominent feature in the business of the new company.

The large accession of capital and the more compact organization attending these changes, together with the considerably improved position of some of the Edison patents resulting from the recent decision of the United States Supreme Court in the Bate refrigerator case, add material strength to the position of the Edison interests in the competition with their energetic rivals in the business of electric lighting.

The arrangement between the Westinghouse Electric Company and the United States Electric Lighting Company, announced a few days since, proves to be to all intents and purposes a consolidation of the two interests under the control and management of the first named organization.

The United States is one of the oldest and best known electric light companies in the country. It has always done a large business, but has been seriously handicapped by the unfortunate necessity incident to many pioneer enterprises of expending large sums of money not only in experimenting and in litigation, but in the reconstruction of its early plants in order to keep pace with the rapid progress and development of invention. It has, moreover, borne a large share of the costly burden of educating a skeptical public to appreciate the manifold advantages of electric illumination and of overcoming the endless legal and other obstructions due to ignorance and prejudice, labors which while necessary and unavoidable are by no means pecuniarily profitable.

The value of the service thus rendered by the United States Company to electric interests has been but scantily appreciated, even by those who are profiting most largely by it at the present day. The union of its fortunes with those of a strong and energetic concern, like the Westinghouse Company, will enable the United States stockholders to reap something like a fair share of the results of their own labors and sacrifices.

This consolidation is but another proof of the inevitable tendency of events, which we have frequently pointed out, toward an ultimate union of the important electric light companies under a common executive management. Practically, the present consolidation leaves but four strong orgaizations in the field, if we except the Western Electric Company, which, of late, manifests indications of an intention to increase the scope of its great general electric business, by taking a larger part than heretofore in the field of electric light and power at some future and not very distant day. The electric lighting business, on the whole, appears to be rapidly getting down to a business basis.—*Electrical Engineer.*

A Plumber's Trick.

The *Sanitary News* describes a new plumbers' trick, which has been first discovered in Milwaukee, but may be known elsewhere, so that architects and inspectors will do well to be on their guard against it. In Milwaukee, as in many other cities, all soil pipes put up in dwelling houses must be tested by filling them with water. A certain firm, knowing that a defective pipe had been used, contrived to plug it with clay, so that the water applied for testing it did not enter the pipe at all. It is not stated how the inspector happened to find out this ingenious deception, but he did, and the offending firm was reported, and punished by having its license revoked until the defective pipe should be replaced by a new one. Most persons will say that the revocation of the licenese ought to have been made permanent.

Cost of Great Guns.

The following are the costs to the British government of a few large guns:

100 ton Armstrong gun	$93,715
80 ton muzzle-loader	47,055
63 ton 13½ in. gun	54,995
38 ton muzzle-loader	15,995

Ten Years' Progress on the Congo.

It is ten years in November since Stanley, returning from his great journey down the Congo, was met at Marseilles by two representatives of the King of the Belgians, who was anxious to enlist the services of the distinguished explorer in furthering his plans for establishing a new African state. Since that date much has been done to carry out King Leopold's great enterprise, and the result of the ten years' labor has been thus summed up by an officer of the state. The Lower Congo has been opened up to navigation by large vessels as far as Boma, soundings have been made and the course marked out by buoys, a cadastral survey of the Lower Congo has been made as a step toward the preparation of a general map of the entire region, justice is regularly administered in the Lower Congo, and a trustworthy and cheap postal service has been established. In addition, registries of births, deaths, and marriages have been established for the non-native population, and it is expected that soon the natives near the stations will also be brought within the scope of the registrar's returns. At Banana, Boma, and Leopoldville medical establishments under the direction of Belgian doctors have been founded, and a considerable armed force of blacks, officered by Europeans, has been called into existence.

The caravan route between Matadi and Leopoldville is as free from danger as a European road, and a complete service of porterage by natives has been established. A railway has been projected and the route almost entirely surveyed. The state has established herds of cattle at various stations, and in the very heart of Africa, on the waters of the Upper Congo, there is a fleet of steamers every year increasing in number. A loan of 150,000,000f. has been authorized, and the first issue subscribed. Many of the more intelligent natives from the country drained by the Upper Congo have taken service with the state, and numerous trading factories have been established as far up the river as Bangala and Louebo. In addition, several private companies have been formed for developing the country, and, finally, geographical discoveries of the greatest importance have been made, either by the officers of the state or by travelers who received great assistance in their work from the state.

The Waste of Natural Gas.

Considerable comment has been occasioned by a circular recently sent by the Philadelphia company to the manufacturers who use gas, requesting them to prevent, so far as possible, the waste of fuel at their works. The request, the circular suggests, can best be carried out by the managers of the various plants instructing watchmen, furnacemen, and other employes to shut off the gas from all furnaces or other parts of the mills when the latter are not running. It has been asserted that the circular referred to is proof that the natural gas supply is fast failing, that Pittsburg's mills and manufactories must soon return to the use of coal, and that even private consumers will, before long, find the gas inadequate.

The fact is, the circular mentioned is similar to that issued every year since the use of the natural fuel became general, and is intended merely to urge the manufacturers to a more economical use of the supply. For over a year past the Philadelphia company officials have been measuring the consumption of gas, making tests on improved furnace appliances and otherwise investigating the fuel waste in the various mills. From the investigations in this district, figures have been deduced showing what a large proportion of the natural gas is wasted here. As an illustration, we append the following figures, given by the Philadelphia company, showing by exact measurement the amount of gas required and the amount used to make a ton of iron in a puddling furnace of the ordinary style:

Gas consumed in actual work.	Gas consumed through whole time.
48,264′	65 234′
38,900′	58,850′
38,264′	55,869′
34,563′	48,144′
27,372′	40,811′

This record was taken in five of Pittsburg's leading mills. The figures in the right hand column show the waste occasioned by burning the gas too high between heats, excessive use of the gas in keeping furnaces hot between turns, and the thousand and one ways in which careless employes waste the fuel because it comes into the mill without hauling. When the Philadelphia company saw the loss occasioned, an effort was made to introduce furnace improvement, with the idea of economizing in the use of gas. In one mill great care in handling the gas had brought the consumption down to 21,535′ in making a ton of iron; improvements further reduced the consumption to 15,953′. The best result yet attained was when a ton of puddled iron was produced in an improved furnace with an expenditure of 12,100′ of gas.

The companies further complain that gas is expended in the most unwarrantable manner. At one mill, and that not a large one, where measurement was taken, it was found that 3,000,000′ of gas had been used between Saturday evening and Monday morning in merely keeping the furnaces warm. When coal was the only fuel, mill furnaces were allowed to become comparatively cool from the time that one turn finished work until another came on, but with the gas everything is kept at a white heat whether in operation or not.

Representatives of the gas companies say they have visited glass factories when no one was at work, yet the gas was burning at a full head, because in many instances "the watchman forgot to turn it down."

On the whole, it is estimated that at least 50 per cent of the gas now used in the Pittsburg mills is lost through ineffective methods and bad management.—*American Manufacturer.*

A Large Meteor.

A correspondent residing at Haddonfield, N. J., writes as follows:

This afternoon, February 7, at 5:20 o'clock, I heard a very loud noise like the report of a tremendous explosion, as if it might be a long distance away, at least as far as Philadelphia, which is six miles from this place. Soon after the explosion, my son, who had been skating on the lake, came home and gave the following account of his experience. He said that while skating he noticed a bright light, and looking heavenward he saw a ball of fire—about as bright as an electric light and of the size of a small football—traveling rapidly through the air from south to north. The fire seemed a great distance above him, and continued to burn until it was far toward the north, when it suddenly broke into fragments, and in its place he saw a great number of seemingly large sparks shoot in all directions, and in a moment came the loud report.

The phenomenon is thus described by John Ingram, of Landing Station, Lake Hopatcong, Morris County, N. J.:

"It was, as near as I can tell, ten or twelve minutes of six, as the whistle at the powder mill blew for six soon after the meteor appeared and exploded. My son William and I were busy stowing ice, when suddenly the heavens were lit up with an intense glare. We looked up, and from the southeast saw a ball of fire, apparently not more than 100 feet from the earth. It resembled the headlight of a locomotive, and was followed by a long, funnel-shaped trail of greenish-blue fire. It seemed to be descending at an angle of about 30 or 35 degrees. After crossing the lake, it suddenly changed in hue to an intense red and threw off myriads of sparks. It came directly athwart the wind, which was blowing at the time a moderate gale from the east northeast. The display lasted, as near as I can calculate, about ten seconds, when there was a terrific explosion, and myriads of sparks flew in every direction and the meteor disappeared. One large fragment seemed to strike the ground not more than 500 feet from my ice house. I visited the place later and found that the ground had been disturbed and some fragments of what may be meteoric stones were scattered about, but the country hereabout is so covered with iron ore that it will be hard to determine whether the fragments are aerolites or not. I intend to make a further search."

A Danger Peculiar to Residence in Flats.

The *Lancet* (London) raises its voice of warning to apartment house occupants, which is worth considering. An ordinary householder has access to every portion of the building in which he lives, and should he suspect a defect, he can ascertain how far his suspicion is correct, and remedy it. But in the case of flats, while the actual apartments rented may be free from all risk of evil, the tenant is, in point of health, almost entirely at the mercy of his landlord and of the occupiers of the basement, in so far as the main drainage of the premises is concerned. If this latter be wrong, the whole mansion is apt to be filled with foul air from below upward. A number of cases have come under our notice in which very serious ill health has been thus induced, and in which tenants have only been too glad to pay what was demanded of them in order to get out of the premises with the least possible delay. While no one should take a residence without skilled advice as to its sanitary state, this precaution is more than ever necessary in the case of flats, where the entire premises, including, above all things, the basement, should be thoroughly overhauled.

Dyeing of Garments.

Pure colors upon garments can be obtained only when the material is first perfectly cleaned. For this purpose brush the stains with a lukewarm strong solution of soda, then work for half an hour in a solution of medium concentration, rinse well, and lay down for several hours, preferably overnight, in warm water. For bright colors, such as red, bordeaux, etc., boil the goods in water, in order to remove any trace of alkali from them, which is necessary for a good dye. To neutralize any remaining lye by acids is an erroneous notion, because it dulls the colors and shows the fades after dyeing. The less acid is used in dyeing, the better are the fades covered.—*Textile Colorist.*

Modern Guns.

It is probable that the explosion of the 34 cm. gun of the Admiral Duperre is a fortuitous accident, deplorable since it caused death, but which should in nowise cast doubt upon the efficiency of our armament.

The doubtful pieces should be replaced by those which have been re-enforced, and themselves strengthened, as they can be rapidly. Even with the improved pieces it seems wise to diminish the service charges to those originally adopted, without regard to the improved quality of the powder. This will reduce the pressure with but 30 meters loss of velocity. Competent persons have asked whether the accident was not due to the powder itself; this is hard to decide, for the true cause of the unbreeching it is impossible to determine.

The modern navy, with the splendid engines it employs, is very difficult to manage. In time of peace, to keep in order its valuable, complicated material, the machine must be mounted with such care, and used with so much caution, that one may well ask whether mechanical science has not passed the limits of what may be demanded of it for ships of war. In case of war, a conflict between two squadrons, serious injuries for all the combatants, victor and vanquished alike, would reduce the ships to helplessness for a long time. The empire of the sea will then belong to the one who can put in action a reserve fleet, even if it should be composed of mediocre vessels, all old-fashioned. And that will not be the least curious phenomenon; the nations which have not kept these reserves will be astonished that their fleets cannot again go to sea without extended repairs in the dockyard. Besides, the wounds of the combatants will make them unserviceable for months, if not for years.

The remedy is to establish an armament of spare stores; but it is expensive. And then every four or five years some progress would be made, and without absolutely condemning the entire past, would arouse regret that so much had been spent upon engines of war which were far distanced by the productions of the day. Since 1875, we have adopted two models superior to our first steel artillery. Artillerists have learned to appreciate that metal, metallurgists to work it in such a way as to give every satisfaction to the demands, as legitimate as they are severe, of the markets for which they work. A revolution has overturned the manufacture of powders and explosives. In 1875 we had already replaced the fine, quick-burning powders by the large-grained slow powders; these have given way to chocolate powders, which now are disappearing in their turn before the white powders. Each improvement has diminished the pressure, that is, the fatigue, of guns and increased their usefulness.

Progress often costs very dear, but to fail to recognize it is to be destroyed. The cannon of 1875 were adopted in spite of the opposition of many artillerists; but may it not be said that if their opposition had prevented action, we should still be fitted out with cast guns, hooped and tubed, instead of the splendid steel artillery manufactured during the past ten years?—*The Yacht.*

Watertight Match Box Wanted.

Bishop, who made a thousand-mile voyage in a paper canoe, says that R. B. Forbes, of Boston, once gave him a watertight pocket match box, that he lost it, and was never able to find another. Thousands of hunters, canoeists, and others have hunted and longed for a match box that would be watertight—one that would preserve its contents dry even though the owner was compelled to take a swim with the box in the pocket of his pants, and the pants on the swimmer. An upset in the wilderness or on the coast, away from dwellings, often destroys every match a man has with him, and places him in a position of great danger.

Though match boxes are made in innumerable styles, we have never been able to find one which was suitable for carrying matches in the pocket and would at the same time protect them from water. There are some difficulties in the way of inventing such an article, because when carried in the pocket the air within the box is rarefied by the heat of the body. When the box is plunged into cold water a partial vacuum is formed, and this aids in forcing water through the joints.

Trees with Large Leaves.

Trees of the palm family have larger leaves than any others. The Inaja palm, which grows on the banks of the Amazon, has leaves which reach a length of from thirty to fifty feet and are ten or twelve feet in breadth. Specimens of the leaves of the Talipot palm, a native of Ceylon, have been met with that were twenty feet long and eighteen feet broad. These leaves are used by the natives to make tents, and form very efficient shelters from the rain. The leaves of the double cocoanut palm are often thirty feet long and several feet wide. When the wind is strong they clash together with a noise that may be heard at a great distance. Only one leaf is produced each year, and they are so firmly attached to the stem of the tree, and so strong in themselves, that a man may sit on the end of one and rock to and fro in perfect safety.

Pipe Stoppers or Plugs.

The iron lines of all plumbing work done in New York City are tested under pressure before the work is passed. The amount required varies under different forms of test. The lowest is about 10 pounds air pressure, while the highest may be as high as 40 or 50. The latter figures are obtained when a water test is employed. A pressing need is felt for a good plug or stopper, which can be used to close the ends of the pipes. The objections to those in the market are that they are rather expensive, do not make tight joints if the pipe is rough, and are not durable. Some become almost useless after having been used but once or twice.

The following are some of the requirements: When put in place, the plug must be tight under water or air pressure up to 40 pounds per square inch. It must be quickly put in and removed. It must work as well on rough pipe as on smooth. Must be easily applied. Must cost no more than those now in use. Must be durable. Must be arranged so that a gauge or pump can be easily applied by means of a nipple. Plaster of Paris is much used for the purpose of closing pipes. It takes some time to set, leaks air when old, and will not hold water for more than twenty-four hours. It would answer fairly well if some preparation could be added to it that would make it really waterproof, and at the same time prevent it from leaking air. A cheap cement for holding a cap in the end of a pipe would also be valuable. It ought not to be too hard, or the pipe is liable to be split in removing it.

Still another problem is found in stopping the house drain. It is to make a plug which shall enter a 4 inch hole, or branch, and, turning at right angles, stop a 5 inch pipe. Another size needed should go into a 4 inch hole and, turning at right angles, stop a 6 inch main pipe. This field is promising, because up to the present time nothing that is satisfactory, or that meets any considerable number of the more important requirements, has yet been produced.

Recent Trials of the Divining Rod.

Among the letters of inquiry frequently received, the divining rod periodically appears as the subject of a question. Some correspondent writes asking where he can procure a "metal rod," or an apparatus for discovering hidden metal. Now it happens that there are two genuine methods of detecting hidden metals and ore. One depends upon the induction balance, applicable to metals only, which has had a very limited application in locating bullets in the body of a person who had been shot. It has often been used with much success even for this minor application, while for work in the field it is entirely unsuited. The other method is applicable to some varieties of iron ore only, and involves the use of the magnetic needle, generally the dipping compass. Although the divining rod is absurd and ineffective, and is frequently fraudulently produced, a full and unlimited negative answer cannot be given to these queries in the light of the induction balance and dipping compass.

The divining rod consists of a forked twig with arms six inches or a foot long. If the end of each prong is held, one in the right and the other in the left hand, and the two ends are bent outward, it will be found that the least movement of rotation of the hands will cause the rod to swing violently upward or downward according to the direction of rotation. These motions are directly produced by the operator, yet they are attributed to and used as the indicator of buried treasure or of hidden springs of water. This is the true explanation of the action of the rod, one which appeared many years ago, and which can be found in Hutton's Recreations in Mathematics, a work now out of print and difficult to find.

Within the last six months several accounts of the use of the divining rod have been published in English journals. The rod was there subjected to serious trials, and from the reports it appears that many people have full faith in it. The accounts give the names of the supposed mediums, and other details of the performances, and in several instances it is perfectly evident that the absurd operations were fully believed in by the observers. The London *Truth*, in a recent issue, gives an account of a meeting held to test the efficiency of the divining rod, and not to utilize its powers directly. A number of professors of the occult art were present. One of them was somewhat noted as having been retained by the Tiverton Town Council to advise where wells should be sunk for the water supply of that borough. This extraordinary fact puts the credulity of one of the English local governing bodies in strong light. Four diviners tried their rods in a garden in the environs of London, in all cases with negative results, or with success easily accounted for by powers of the most ordinary observation. Thus, a hydrant and a tank being discernible, one medium located water on the line between them, just where it was evident that the communicating pipe should be. Among those present was Mr. Frank Podmore, an officer of the Psychical Research Society. With two other gentlemen as a committee he arranged a special metal test. Five sovereigns were hidden in one of five books placed upon a billiard table. The rod indicated metal in several places, among others in the neighborhood of the sovereigns and over the corners of the table where some one had remarked that the brass of the pockets was situated. Eventually the rod indicated metal in a book which was examined and found to contain none. A purse was laid upon the table, over which the signs of metal appeared when the rod was held over it, but on investigation the purse proved to be empty and without a particle of metal about it. The unsuccessful operator it is stated disappeared after his fiasco. This individual had his meed of fame, derived from previous exhibitions of his alleged power, which some two months before he had given at Lisburn, at a meeting of the North of Ireland Association of Gas Managers. For them he had located the gas and water mains. But when put to the trial above detailed, as well as others of a similar nature which it is not necessary to repeat, he failed ignominiously.

The Psychical Society have also been investigating the matter. A diviner was set to work in a certain field. He was made to locate two spots, one where water would be found, another where it would be useless to dig for it. The society accordingly had two wells dug, one in each spot, and water was found in both.

Last December the guardians of Hastings in England were engaged in sinking a well under the directions of a diviner, thus emulating the Tiverton authorities in credulity. It is quite possible that if they dig deep enough, they will find water. Sixty or seventy feet was given as the probable depth, but from an English journal of January 22 we hear that a depth of one hundred feet was reached without finding any.

[FOR THE SCIENTIFIC AMERICAN.]

How to Save Ceilings when Cracked, Sagging, and Ready to Fall.

The ceiling must be first pressed back firmly into place. To do this take two pieces of scantling, long enough to reach over the defective part. Nail upon them laths about two or three inches apart. Place this framework, lath side up, against the plastering above them. With other pieces of scantling, reaching from this framework to the floor, support and lift it up against the ceiling, driving wedges under the floor end of the supporting scantling, which will bring the ceiling in place and keep it there.

To prepare the nails: Put them in a vise. With a hack saw, saw slots in their heads like a screw (only slightly, but so that a sharp screwdriver will hold in the groove), then with the screwdriver turn the nail to the right and then to the left, gently pushing it, first through the plastering, then into the lath above, still pushing and gently turning. The head of the nail can be screwed into the plaster flush, so as to make a neat job, and hardly be noticeable on the floor beneath. The nails hold very firmly. Once in every 6, 8, or 10 inches square for a nail is usually sufficient. If the plaster is very porous and shaky, small copper washers may be used on the nails, but it must be very far gone to need them. Driving nails in with a hammer would destroy the whole fabric. Take down your lath framework, and there you have your piece of ceiling as firm and nice as ever it was. JOHN A. WHIPPLE.

40 State Street, Boston.

Natural Gas in Indiana.

Some idea of the vast importance of the natural gas interests of Indiana may be gained from a study of the report recently made by the State geologist. He has been collecting all the information he could possibly get concerning the subject, and from the results of his investigations we learn that the gas area of Indiana is 165 miles in length by 65 miles in width; altogether there are 381 paying wells in the district. The entire flow of gas is placed at 600,000,000 feet, of which, it is calculated, something like 1,000,000 feet go to waste. The average flow of gas from each well is stated as being about 150,000 feet. The report further mentions the fact that during the past two years seventy-nine manufactories have located in Indiana, simply and solely because of the fact that they could obtain this fuel. Their combined capital is stated, in *Fire and Water*, as reaching $4,500,000, and it is said that they will employ 5,800 men.

Blowing Wells.

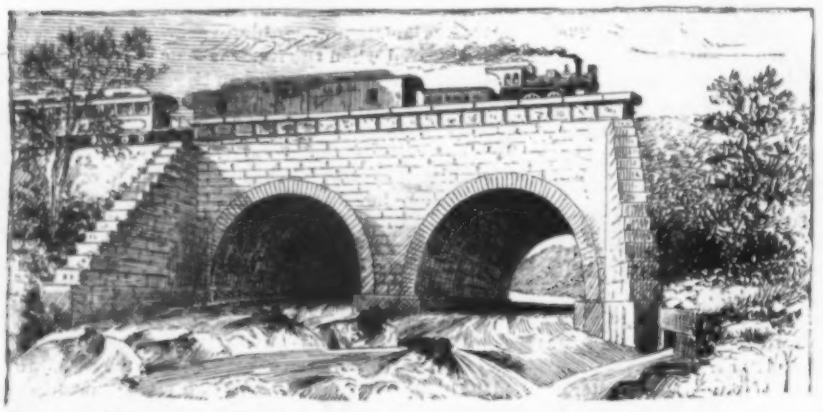
A correspondent writes from Eckley, Washington County, Colorado, stating that they have a 6 inch bored well over 200 feet deep—the first 5 or 6 feet through a stratum called native lime, the balance being clay soil and gravel—water being found in quicksand. The well seems to act as a barometer, before a storm blowing pure-smelling cool air with a force that is heard in a house 30 yards away; as the storm passes, it sucks the air down with an equal force.

The country is very level, or what is there called a flat, having sand creeks or gravelly waterways, where water can be had at a few feet below the surface, while at a quarter of a mile each way it is only found at a depth of 200 feet. There are several of these blowing wells in that vicinity.

THE IMPROVEMENT OF THE RAILROAD APPROACHES OF NEW YORK.

(*Continued from first page.*)

The main passenger line crossing the drawbridge



MASONRY ARCHES OVER STREAM, MAMARONECK.

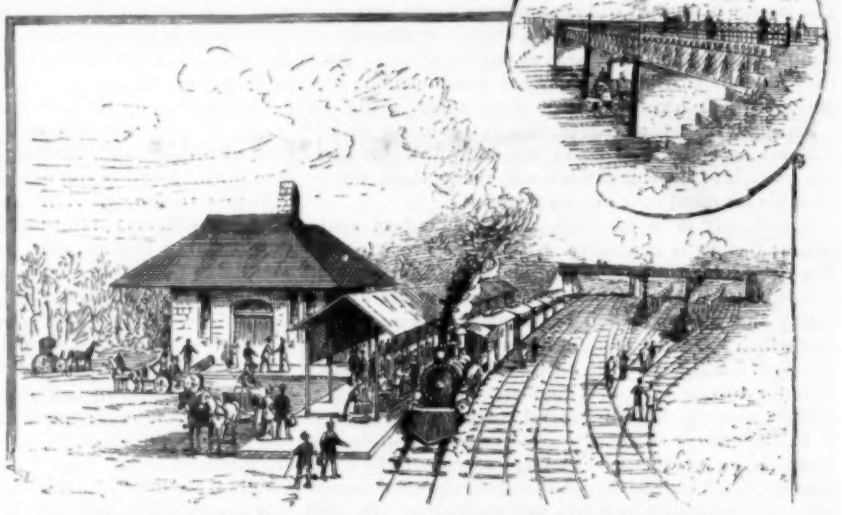
already spoken of runs north, and at Williamsbridge begins to sweep to the eastward, and then, passing through Mount Vernon and New Rochelle, goes to New Haven. From the Mott Haven yard a road called the Harlem River branch runs eastward close to the shore of the East River and Long Island Sound and meets the main line just to the west of New Rochelle. Thus up to this point there are four tracks, which begin at the Harlem River. Below the river, the road has to use the Fourth Avenue tunnel. Up to Williamsbridge it uses the same tracks as the Harlem road. The improvements illustrated in the present issue commence at the New Rochelle junction. One of the illustrations, taken from a point looking eastward, shows the beginning of what may be termed the new road. It consists of four parallel tracks, stone ballasted for their entire width. The old line contained a number of steep grades and sudden turns. The new line effects a great improvement in both these respects. The road is straightened out so as to reduce the curves, and also to shorten the distance run. The diagrams showing the new and old routes near Harrison and Rye are given as examples of the class of work done as regards alteration of line. The grades have been also much reduced. In places the level has been altered seven or eight feet. Grade crossings are also abolished. Where roads cross the track, iron bridges, as a rule, are used to carry the trains above the wagon roads, or to extend the wagon road across the track. Samples of the standard type of road and railway bridges are shown in one of the cuts. In some places masonry bridges already in existence have been utilized by being widened so as to carry the four tracks. Several examples of this exist at Mamaroneck.

In this way the work has been carried out as far east as Portchester. In the ten miles thus far completed there are no grade crossings. For all the important stations new stations have been erected. The entire line is run upon the block system, whose semaphores form a conspicuous feature of the road. They are actuated by signal men stationed in the towers at the side of the track. Each pair establishes a "block." When a train is to enter the block, the semaphore at the beginning is dropped, and at once raised to the danger point as the train passes. It is locked in this position, and cannot be dropped to indicate safety until the train has passed the next signal tower, and has left the block, and the next semaphore has been lowered. Each signal man is a telegraph operator, so that in case of an accident they can communicate with each other. Three miles is the greatest length of a block, but near New York it is much shorter. Trains can run with perfect safety on two or three minutes' headway.

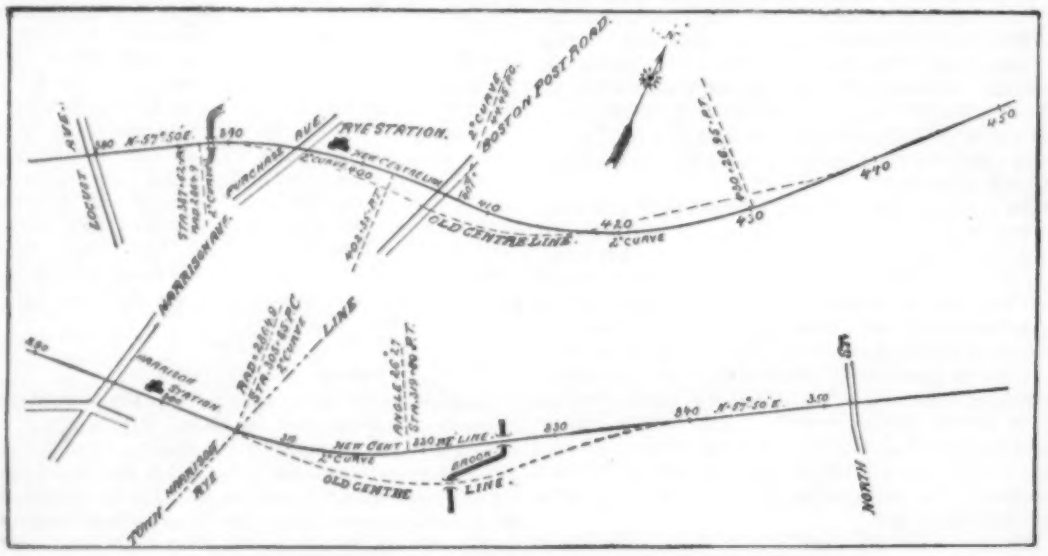
The engravings show various scenes along the line of improvements, and the eastern limit of operations is seen at Portchester. Next summer the work will be extended beyond this point, and, in the near future, a four-track road will run to New Haven. Then the road will show probably the finest stretch of railway in the United States.

The New York Central road is engaged also in an undertaking of much importance. Starting at the natural grade, at Mott Haven, and returning to it just beyond Jerome Park station, the tracks used by the Harlem and by the New Haven road are being depressed below the street level. The work, as yet, has not progressed very far. The roadbed is to be lowered well below the grade, and the excavation is to be lined with cut stone masonry work. We illustrate the work in progress at Melrose, at which point the masonry has been carried to the highest point. This portion of the city is becoming so thickly populated that it was found imperatively necessary to abolish the many grade crossings.

The two undertakings described show that the railroad authorities realize the importance of providing for future growth of business. The Grand Central Depot has been already increased in size, but is now hardly adequate for its work. A slight increase in facilities has been effected by running the trains on the left hand tracks, as seen in the cut of Melrose. It is not improbable that in a few years one or more new terminal depots will be erected on the further side of the Harlem River. The immense tract of land owned at Mott Haven by the New Haven road is very suggestive of a mammoth passenger depot.



NEW STATION AT RYE, AND THREE-SPAN BRIDGE.



STRAIGHTENING THE N. Y., N. H. & H. LINE.

Natural Gas.

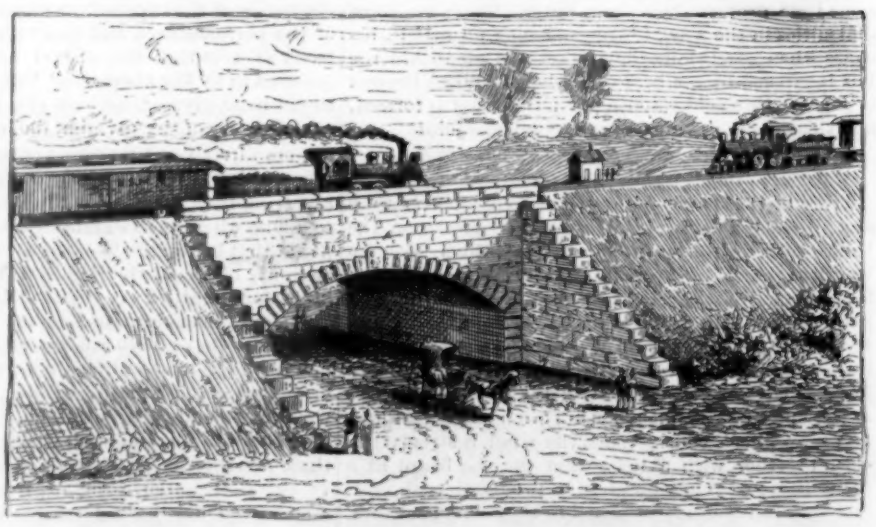
In piping for long distance gas transit, the pressure loses 5 lb. per mile for the first 15 miles, and 2½ lb. additional for each succeeding 15 miles, so says a Western authority. This means the loss of 75 lb. pressure at 15 miles and 200 lb. pressure at 30 miles. This may be possible with small pipes using the whole flow. The real loss in pressure depends upon the relative size of the pipe to the quantity of gas consumed at the end of the line, for, if the pipe is closed, the pressure at both ends would soon be equal.

Electric Railways.

The *Electric World* says that, one year ago, there were barely a score of electric roads in this country, and about another score were projected. To-day there are over fifty roads, and nearly seventy more are building or under contract. There is still plenty of room for improvement in the methods adopted, but the roads work and are certainly good enough to advertise the method as a success. We may well apply to this the language that Professor Bryce in his recent noble work on the "American Commonwealth" uses about some of our political conditions: "The Americans surpass all other nations in their power of making the best of bad conditions, getting the largest results out of scanty materials or rough methods. Many things in that country work better than they ought to work or could work in any other country." After all, there is no better way of reaching perfection than through experiment and failure, and every one of the successes in electric railroading in this country has been won by the very finest qualities of grit, self-help, and shrewdness. Our motor engineers know something now about electric roads, and have laid the foundations of an enormous industry by their genius and perseverance.

The Elm Beetle.

During the last summer Washington and other Eastern cities of the United States were exceptionally free from the attacks of "shade tree pests." Elm leaf beetles were not nearly so numerous as usual. In recording this fact in *Insect Life*, the writer refers to "an occurrence which shows how careful one must be in drawing conclusions from experiments to destroy insects." "Counting," he says, "upon the ordinary appearance of the elm leaf beetle, we sprayed the trees in our garden with London purple early in the summer, and as no damage was done, we were quite of the opinion that the spraying had been a success until, later, we noticed that unsprayed trees were quite free also. In the same way a gentleman came to us toward the end of the season and informed us that he had completely protected his trees by spraying the grass under them with Paris green, his trees for the first time in several years having retained the verdure of their foliage."

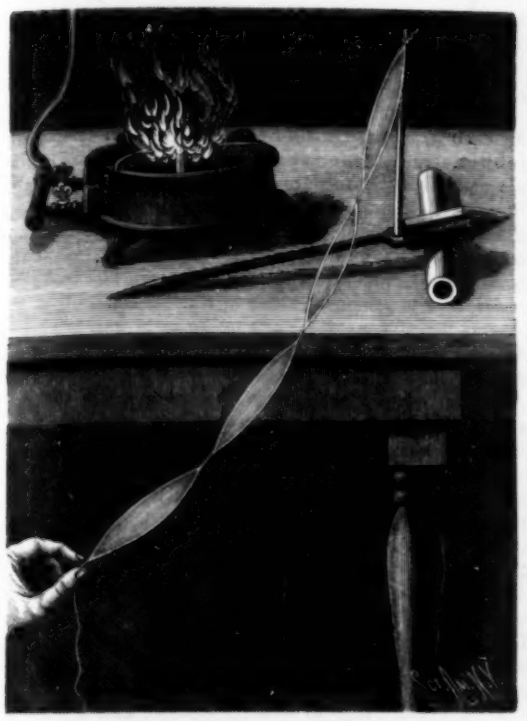


MASONRY ARCH OVER HIGHWAY, MAMARONECK.

MELDE'S EXPERIMENT WITH THE TREVELYAN ROCKER.

T. O'CONOR SLOANE, PH.D.

A very simple way of performing Melde's experiment, in which visible loops and nodes are produced upon a long thread, is shown in the cut accompanying this description. The well known phenomenon of the Trevelyan rocker is utilized and made to take the place of a vibrating diaphragm. As Melde's experiment



MELDE'S EXPERIMENT WITH THE TREVELYAN ROCKER.

is usually performed, a tuning fork is the source of vibration. A fine and very flexible thread is attached to the extremity of one leg of a tuning fork, and is held in a generally horizontal position, of course curving downward. If stretched to the right degree of tension, the thread, when the fork is vibrated, will be thrown into a beautiful series of loops and nodes. This is not all. By varying the tension of the thread, the nodes can be varied in number, two, three, or more loops being produced. The looser the thread is, the more loops will be developed.

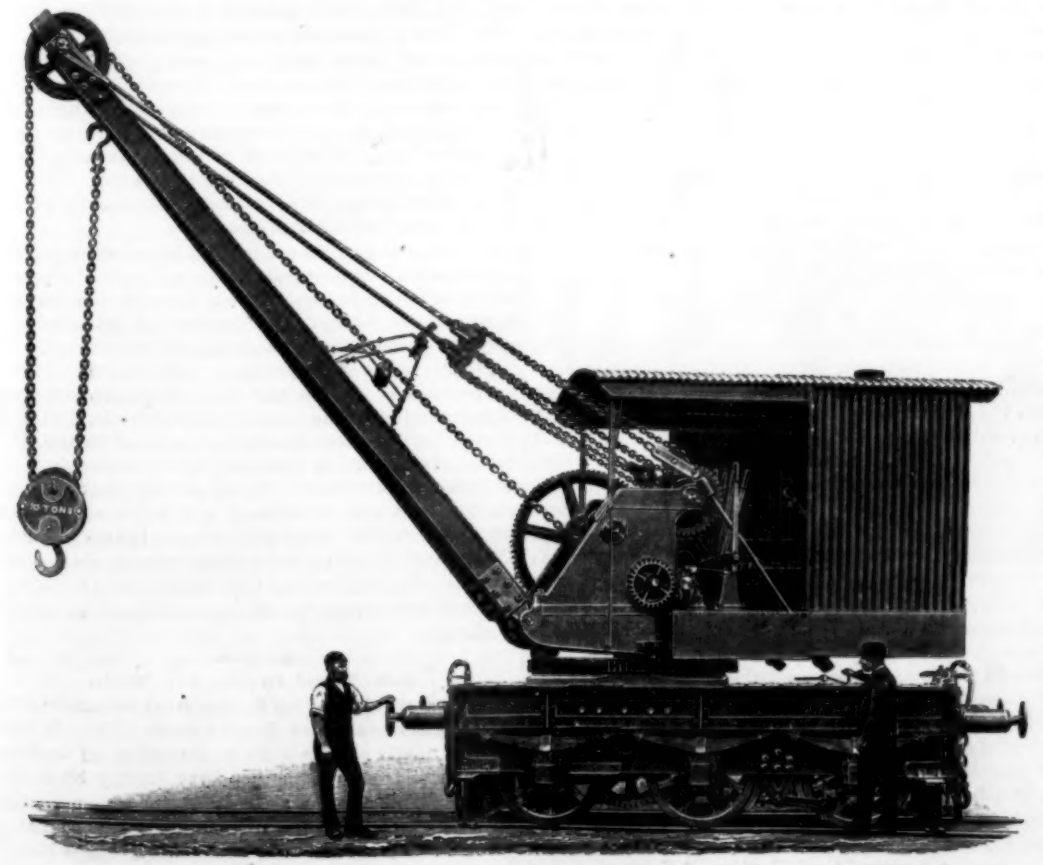
It will be evident that some adjustment is required, and it is in this respect that the common tuning fork is a failure. It will only vibrate for a short period, and gives little time for adjustment. While it is sounding, its note cannot be changed. In the Trevelyan rocker is found an extremely simple way of producing vibratory motion that will continue for many minutes. If a soldering iron is heated and laid with its head upon a piece of lead pipe, and the end of the iron handle resting on the surface on which the pipe lies, a very efficient rocker is produced. If the bolt is tilted a little to one side and released, it falls back to its first position, and at once begins to rock back and forth very rapidly, producing a musical note. The usual explanation of the phenomenon is that the lead is heated as the iron strikes it, and throwing up little elevations, first at one and then at the other corner of the bolt, under thermic expansion, keeps the bolt in oscillation. Another feature will be observed. A soldering iron of octagon section should be used. It has sides of two sizes, its cross section being a square with truncated corners. If placed upon a narrow side, it rocks slowly through a considerable amplitude; if placed on the wide side, it rocks much quicker and with less amplitude. Furthermore, the note can be changed by pressing with the point of a penknife vertically down upon a point over its axis.

To produce loops and nodes a stick about five inches long is secured to the hot iron by driving into the fork of the iron handle. A silk thread is tied to the end of the stick, and the rocker is started. The other end of the string is now held in one hand and the tension varied until the right point is reached, when suddenly the thread, hitherto quiet, starts into action, and is thrown into a series of beautiful loops, as shown in the illustration. The string may be ten or fifteen feet long. By increasing or diminishing the tension, the thread will again become quiet, and again will move, producing a different number of loops. As the rocker will keep moving for ten minutes or more, there is time during a single experiment to vary the effect indefinitely. The rocker may be used upon its short or wide side, with different results in each case.

Another way of changing the number of loops may be tried. The thread in this case is stretched across the room and secured at such tension as to produce one series. Then, by pressing on the iron with the point of a knife as described, its note may be raised, and the loops will cease to appear. If a still further variation is produced, a different series may appear. It is easy by this change to throw a quiescent string into motion, or to stop a moving one; but it is difficult to successfully carry the thread through two phases of vibration. In the time afforded for experimenting, and the variations that can be produced, the method is far superior to the ordinary one.

If the string is held as shown, it makes two vibrations for one of the rocker. If held in the prolongation of the axis, so that the stick swings across its line, its vibrations correspond in number with the oscillations of the bolt.

An experiment of some interest can be performed by placing a microphone and battery in circuit with the lead pipe and rocker. One end of the wire should be in contact with the pipe, the other with the end of the handle of the rocker. The telephone then reproduces the sound very loudly, showing that if not an absolute make and break, a very great change of contact is produced by the motion. The telephone may then be placed in circuit with a microphone, and the pipe may be placed upon the base of the latter. Upon starting the rocker into action on the pipe, the telephone responds loudly with much the same note as when the rocker was in the direct circuit. These supplementary experiments go to show that there is a certain field of experiment open for the rocker. It will be found an admirable producer of rapid oscillatory motion, so that it can be utilized in many other experiments than that of Melde.

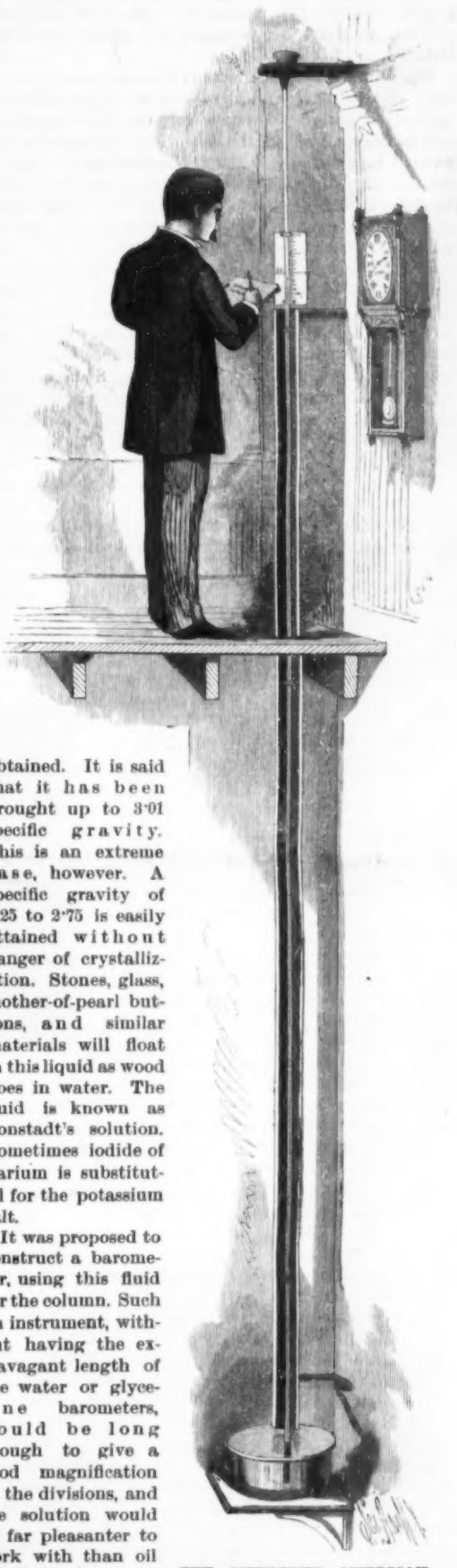


IMPROVED TEN TON LOCOMOTIVE CRANE.

FOR DESCRIPTION SEE PAGE 136.

THE SCIENTIFIC AMERICAN IODIDE OF MERCURY BAROMETER.

If iodide of mercury is dissolved in iodide of potassium and water, a liquid of very high specific gravity can be obtained. It is said that it has been brought up to 3·01 specific gravity. This is an extreme case, however. A specific gravity of 2·25 to 2·75 is easily attained without danger of crystallization. Stones, glass, mother-of-pearl buttons, and similar materials will float in this liquid as wood does in water. The fluid is known as Sonstadt's solution. Sometimes iodide of barium is substituted for the potassium salt.



THE SCIENTIFIC AMERICAN IODIDE OF MERCURY BAROMETER.

It was proposed to construct a barometer, using this fluid for the column. Such an instrument, without having the extravagant length of the water or glycerine barometers, would be long enough to give a good magnification of the divisions, and the solution would be far pleasanter to work with than oil of vitriol, the next liquid practically available that approaches it in weight. The details of the barometer are shown in the cut. It was constructed for and stands in the SCIENTIFIC AMERICAN offices.

The tube is in one piece, and is about ⅜ in. internal diameter. At its upper end it expands so as to form a funnel. It was made open at both ends. As cistern, a cylindrical glass vessel, 9 in. wide and 4¾ in. deep, is used. A round plate of glass is provided for cover. The upper edge of the cistern is ground off so as to form a tight joint with the under surface of the plate. A hole through the plate admits the end of the tube, which, carried by a wooden frame and brackets, rises vertically from the cistern. The latter stands upon a shelf. The tube rising from it passes through a hole in the ceiling and terminates about six feet from the floor

above it. The upper end of the tube is corked with an India rubber cork, to which, by means of a piece of platinum wire, a thermometer is suspended. This hangs down within the tube above the solution, and may be assumed to give a very close indication of its temperature. The funnel holds some metallic mercury, which is used to insure the tightness of closing of the upper end of the tube.

The tube contains Sonstadt's solution. The same is placed in the cistern to a depth of about one inch, so as to cover the end of the tube. The Torricellian vacuum, less the tension of the vapor of water, exists above the solution in the tube, so that a true barometer is constituted.

The filling was thus effected: The tube and cistern were put in place, and the lower end of the tube was corked. Solution was poured into the cistern until the end of the tube was immersed. Next the solution was poured into the upper end of the tube until it rose in the funnel. After standing a sufficient time to be sure that no bubbles existed in the liquid, the India rubber cork, with the thermometer hanging from it, was introduced, the thermometer descending into the tube. As the cork was depressed, it entered the solution in the funnel, and while thus immersed was pressed hard into its seat. The long column of difficultly compressible liquid acted like a solid body and forced out the cork at the bottom, and the column at once dropped to the height due to atmospheric pressure. Some metallic mercury was poured around the cork, and the lower cork floating about in the solution was removed, the plate and cistern were adjusted, and the filling was complete.

The scale was determined by comparison with a mercurial barometer. An arbitrary scale of equal parts was first attached, and its readings were compared with those of a mercurial barometer. A great many readings were taken at varying heights, and from them two average readings for extreme height and depression were deduced. Not only did this give a ratio of parts, but it also fixed the initial point corresponding to thirty inches.

On the basis thus determined a scale marked as for inches and hundredths was constructed and put in place. A number of readings were taken, and an error constant in size, the readings being always too low, showed that the 30 inch point was wrong. The scale was then shifted a fraction of an inch, and a new series of readings were taken. These showed that the instrument was at last correct.

At first the thermometer was read at every observation, and corrections for temperature and tension of aqueous vapor were applied. But it was found that the slight discordance existing between it and the mercurial barometer was not lessened by this correction. Practically both instruments read alike, without any correction, so it came to be regarded as unnecessary.

It is proposed ultimately to cement the glass plate to the cistern and to fill with cement the joint between the tube and plate. Then a small glass tube is to be secured in a second hole in the cover, to the outer end of which tube an India rubber balloon is to be attached. This will exclude air and prevent all evaporation, and yet will allow the atmospheric pressure to act freely upon the liquid in the cistern.

By calculation from the relations of its scale to the true inch, the specific gravity of the fluid is found to be 10-31 that of mercury, or, referred to water, 2·662.

The method of construction adopted has been found exceedingly convenient. On one or two occasions it has been found necessary to open and refill the tube, but no trouble has ever been experienced in doing this. In a long series of readings the greatest difference from a mercurial barometer was 0·055 inch. The general error was about one-third this amount, and a number of readings practically coincided. These comparisons are made with the Draper registering barometer, which is also located in these offices.

TEN-TON LOCOMOTIVE CRANE.

The ten-ton permanent way locomotive crane which we illustrate on preceding page was constructed for the Swedish and Norwegian Railway by Grafton & Co., London. It is driven, says *Engineering*, by a pair of engines having cylinders 9 in. in diameter by 12 in. stroke, and fitted with link motion. The chain barrel is 11 in. in diameter and 4 ft. long between the flanges. The chain is of ⅝ in. iron, and was proved to 25 per cent above the Admiralty strain.

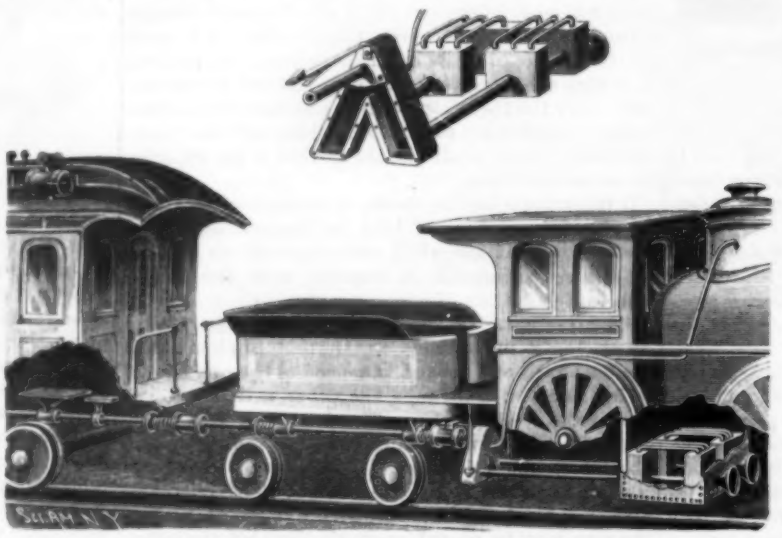
The slewing gear is constructed according to an arrangement patented by Mr. Alexander Grafton. The roller path and the toothed ring, or circular rack, are made in one piece, the anti-friction rollers running on its upper surface, while the pinion travels round its circumference. This combined ring is not fastened to the carriage, but merely lies on a circular turned surface, on which it is retained against lateral motion by a raised ring or flange which fits its interior diameter. When the slewing pinion is rotated, the ring remains stationary, since there is more friction between its lower surface and the carriage than between its upper surface and the rollers. But should any shock come upon the gear, as, for instance, if the jib of the crane should be struck by any moving object, or if the engines should be suddenly reversed in the act of slewing, then the ring will slip on the carriage, and the breakage of the gear, which would otherwise occur, will be avoided. The carriage is mounted on six wrought iron wheels with steel tires. The boiler is 4 ft. in diameter and 7 ft. 6 in. high.

Coal in the Argentine Republic.

According to a consular report, discoveries of coal have been made in the Argentine Republic. A company is now working the Dehera and Colorado coal mines, about sixteen miles from San Juan, in the province of the same name. It is stated that a seam nearly two feet thick has been discovered. Another bed has been discovered and works undertaken at Loude. It is reported that the coal is large, firm, and gives a great heat, suitable for the manufacture of coke and gas. This news has been received with satisfaction at Buenos Ayres, the want of coal in the Argentine Republic and the necessity to obtain supplies from abroad, chiefly in England, having been hitherto considered one of the chief obstacles to the establishment of a native industry able to compete with foreign products.

IMPROVED APPARATUS FOR HEATING CARS.

An apparatus designed to convey heated air from the locomotive to the several passenger cars of a train is illustrated herewith, and has been patented by Mr. Marshal Wood, of Alderson, West Va. Air tubes, having funnel-shaped front ends, open into boxes or reservoirs in the fire box, these boxes being connected to rear ones by a series of small pipes designed to serve as grate bars. From the rear boxes the hot air pipes connect with a triangular-shaped heating drum, shown in the small figure, suspended beneath the cab and connected with a coupling. Each car is preferably provided with two registers. To aid in carrying the heated air to the several cars, the hot air drum is connected by means of a tube with the steam dome, and sufficient steam used to drive the air through the train and afford all the heat desired.



WOOD'S APPARATUS FOR HEATING RAILWAY CARS.

The St. Louis Bridge.

The beautiful bridge built by Captain Eads over the Mississippi River at St. Louis, bold in its design and excellent in its execution, is an object of admiration to all who visit it, but the impression of its importance would be greatly magnified if the part below the surface of the water, which bears the massive towers, and which extends to a depth twice as great as the height of the pier above the water, could be visible. There are three steel arches, the center one having a span of 520 feet, and each side arch a span of 502 feet. Each span has four parallel arches or ribs, and each arch is composed of two cylindrical steel tubes, 18 inches in exterior diameter, one acting as the upper and the other as the lower chord of the arch. The tubes are in sections, each 12 feet long, and connected by screw joints. The thickness of the steel forming the tubes runs from 1 3-16 to 2½ inches. These upper and lower tubes, are parallel and 12 feet apart, connected by a single system of diagonal bracing.

The double tracks of the railroad run through the bridge adjacent to the side arches at the elevation of the highest point of the lower tube. The carriage road and footpaths extend the full width of the bridge, and are carried, by braced vertical posts, at an elevation of 23 feet above the railroad. The clear headway is 55 feet above ordinary high water. The approaches on each side are masonry viaducts, and the railway connects with the city station by a tunnel nearly a mile in length. The great tubular ribs were built out from each side of a pier, the weight on one side acting as a counterpoise for the construction on the other side of the pier. They were thus gradually and systematically projected over the river, without support from below, till they met at the middle of the span, when the last central connecting tube was put in place by an ingenious mechanical arrangement, and the arch became self-supporting.—*Scribner's Magazine.*

Labor in State Prisons.

The Committee on Political Reform, of the State of New York, have recently issued a report on the above subject. For a number of years the prisoners in the prisons of this State were kept at work during the period of their incarceration. They were employed on the contract system. The labor of the prisoners was farmed out to manufacturers of shoes, stoves, and other goods, who made large quantities of manufactured material in the prisons. Much of the work was done by machinery, so that so far as the convicts were concerned, they were only taught a trade in the most limited sense of the term. Many articles were only partly completed in the prisons. The reformatory or educational aspects of labor were really subordinated to considerations of profit to the contractors.

The labor interest of the State, rightly or wrongly, looking upon prison labor as an injurious form of competition, succeeding in bringing about legislation practically abolishing prison labor, and reducing nearly all the prisoners to idleness. The results are described by the wardens of the different prisons as horrible. The body of criminals are left the greater part of their time in idleness, if a walk for exercise cannot also be described as such. The mind and body alike become unhealthy. Restlessness and ennui, leading to death, disease, and insanity, ensue, and the ultimate consequences may be very grave. Already the consignments to the insane asylum have begun to increase. The workers of this great State need protection at no such cost as this.

A prison should be a reformatory. At the best, but little reformation can be effected, but even a neutrality of operation is better than inflicting bodily and mental injury upon criminals. The plea of the committee is for employment for these wards of the State, which shall be so regulated as to have little or no effect upon general industrial occupations.

Assuming all the prisoners to be employed, their proportion to the total labor list of the State is put at fifty-two one-hundredths of one per cent. The committee hold that such competition, properly distributed, can do no harm. It is true that, under the old system, where the occupations covered a very restricted field, it might be felt. Admitting this, anything seems better than to maintain prisons as hot-beds for the fostering of evil habits, indolence, and some of the lowest forms of vice, and it seems perfectly clear that so small a proportion of laborers can be kept busy without perceptible effect upon the true interests of workmen. As compared with outside labor, prisoners are reckoned as having an efficiency of only sixty per cent. This reduces their competition to about three-tenths of one per cent—an infinitesimal amount.

To restore industrial occupation to prisoners, legislation is needed. It is proposed that a law shall be passed directing that prisoners be made to work. To prevent injurious competition, the number of prisoners employed in manufacturing any one kind of goods, according to the terms of the proposed law, shall not exceed ten per cent of the number of free workmen employed in manufacturing the same goods within the State. If this numerical ratio be further reduced by the coefficient of efficiency of prisoners, it will diminish to six per cent effective labor. By proper distribution of employments it can be reduced still lower, so as to approximate to the labor ratio of one in two hundred. The passage of such a law will undoubtedly do the prisoners much good, increase their chances of reformation, and will not perceptibly affect the prospects of outside workmen.

Salt Water in the Gas Wells.

Salt water is beginning to be a great nuisance to the oil and gas resources of Northwestern Ohio. It is invading nearly all the wells and making an immense amount of trouble, some property having been altogether abandoned on account of its presence. Salt water is affecting the gas wells of Findlay to a large extent, more noticeably in the famous "Karg," which at times cannot be used for several days. After a period of rest, however, the disturbing element seemingly disappears, but under high pressure upon the well returns again.

The Danger of Gas.

Much has been written regarding the attempt to put electric wires in gas mains, but far more yet remains to be said about how to keep gas out of electric conduits. Deaths among electric workmen from asphyxia and from injuries due to explosions caused by the presence of illuminating gas in underground conduits are being recorded with an increasing and unpleasant frequency.

What to do to keep the gas out, and if it is present how to render the operation of laying underground conductors a safe one, are problems which confront the electrical engineer. Obviously, if all the conditions were under control of the electrical company, the remedy should be applied to the first cause, leaky gas mains; but as such a treatment of the subject is impracticable, and as accidental leaks may occur at any time even in properly constructed mains, the electrical subways should be made as far as possible gas tight. No matter how much care may have been exercised in the construction of subways, they may at any time be found to contain gas in dangerous quantities, and precautions should always be adopted to guard against accident by those entering the manholes.

A good plan, much used by cable splicers when compelled to work in a manhole which is found to contain gas, is to allow fifteen or twenty minutes for ventilation after taking off the cover before entering; then to proceed to close up with pipe clay all the openings into the ducts. Pipe clay is used in preference to cement because it does not harden and can easily be removed. In those ducts into which cables have been drawn there is between the cables and the walls of the ducts more or less space which should be carefully filled with this clay.

During all the time that the splicer remains in the vault his helper on the surface sends down a supply of air from a rotary blower which is operated by a crank. This keeps the manhole ventilated and renders the work of splicing comparatively safe. Without the sealing up of the ducts all attempts at ventilation may prove useless, because if communication with neighboring manholes is allowed, a sudden draught of air might suck into the working chamber a volume of gas sufficient to smother the workman while his helper was contentedly turning the crank of the air pump on the surface above.

It is well to bear in mind that the treatment for asphyxia is similar in many respects to that used in resuscitation from drowning. If a workman should be overcome by gas, his life may depend on the way he is handled before the arrival of a physician. He should be brought into the fresh air at once. Efforts should be directed toward keeping up the heart's action and restoring the circulation, and for this purpose stimulants may be given. The foul gases should be expelled from his lungs and artificial respiration practiced if necessary.

Unless a general system of subway ventilation is carried out, this plan of sealing up the ducts should be extended to all the manholes whether there are men at work in them or not, otherwise a leak at one point might flood the entire system with gas. Under the latter condition an explosion at one place may be transmitted through the connecting ducts to a number of manholes, causing great destruction.

To detect the presence of gas is not an easy matter, especially in view of the fact that certain kinds of illuminating gas are inodorous. It has often been suggested that some chemically prepared paper, to be used after the manner of litmus paper, which is turned red by acids and blue by alkalies, might be devised for this purpose, but it hardly seems possible that anything of this kind will be produced, as it is necessary to know not only that gas is present, but also in what quantities. It is too much to expect that there ever could be devised an apparatus for the quantitative and qualitative analysis of gases simple enough to be operated by a subway laborer.

All ordinary underground cable-laying operations can be conducted without the use of a torch in the manholes, but there are cases where its use becomes necessary, and in those instances unusual precaution should be taken to make certain that an explosive mixture of gases is not present. The introduction of underground wires has brought with it new troubles, and it would seem for the interest of all that something should be done by the various companies toward securing uniformity of practice in dealing with this dangerous element, which threatens not only the lives of the cables, but also the lives of our workmen.—*Elec. Review.*

Why Fires Burn Brightly in Winter.

There are several reasons why a fire burns so brightly in frosty weather. First, the air being cold is denser, and the heated air and gases from the fire are comparatively more buoyant. Consequently there is a greater draught. Then the air, being denser, contains more oxygen in an equal volume, and that gas being quickly supplied, the combustion is fiercer and more perfect. In frosty weather, too, the atmosphere is comparatively free from moisture, which of course has a tendency to damp a fire.

SIMPLE EXPERIMENTS IN PHYSICS.

BY GEO. M. HOPKINS.

In some experiments described in a former article it was shown that hydrostatic pressure is equally distributed on all sides of the containing vessel. Fig. 1 illustrates an experiment in which are shown the effects of removing pressure from a portion of one side of the vessel, thus allowing the pressure to act upon the opposite side of the vessel in such a manner as to cause it to move. This experiment is arranged to show this action in two ways, one so as to propel the vessel forward, the other so as to cause it to turn.

The apparatus consists of a tall tin can—such as is used by fancy bakers for wafers or fine crackers—

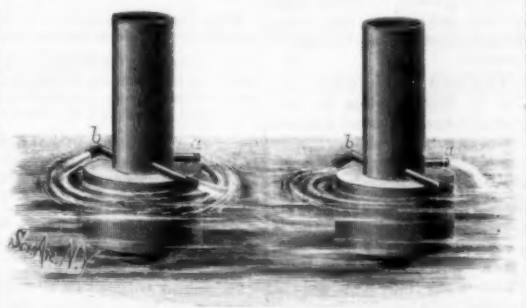


Fig. 1.—REACTIONARY APPARATUS.

mounted upon a wooden float provided with a lead ballast to keep it in an upright position. In one side of the can at the bottom is inserted a short tube, *a*, and in diametrically opposite sides of the can, also at the bottom, are inserted longer tubes, *b*, which reach over the wooden block and have their ends turned in opposite directions. All of the tubes are stopped, and the float is placed in a large vessel of water, when the can is filled with water and the stopper of the tube, *a*, is withdrawn, thereby allowing water to escape from the can, thus relieving the pressure over so much of the area of the can as is represented by the bore of the tube. This disturbs the equilibrium of the lateral pressure in the can, and allows the pressure on the side opposite the opening to preponderate and press the can forward, as shown in the right hand figure.

When the straight tube, *a*, remains closed, and the bent tubes, *b*, are opened, the relief of the pressure results in the rotary movement of the apparatus. In this case the bent tubes are virtually extensions of the containing vessel, and the relief of pressure at one side of one tube causes that tube to move forward, while the relief of pressure at the corresponding side of the other tube causes that tube to move rearward, the resultant of the two motions being a rotation of the two bent tubes, and the parts to which they are attached, around a vertical axis. The apparatus arranged in this way illustrates the principle of Barker's mill.

The hydraulic ram, a simple form of which is illustrated in Fig. 2, depends for its action on the momen-

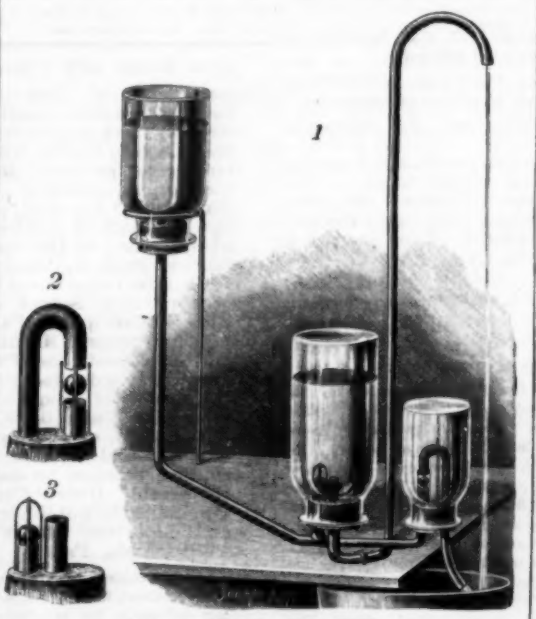


Fig. 2.—HYDRAULIC RAM.

tum of the water column and upon the elasticity of air. The reservoir in the present case consists of an inverted glass bottle having no bottom, and provided with a perforated stopper in which is inserted one end of a tube, preferably lead, on account of the facility with which it may be cut and bent. The other end of the tube is branched, one branch extending through a stopper inserted in an inverted bottle which serves as an air chamber. The other branch of the tube extends to the overflow valve. In the stopper of the air chamber is inserted a second tube, which is bent upward and curved over, forming the riser.

The smaller bottle, which serves as a valve chamber, is provided with a stopper which receives the branch of the supply tube and an overflow tube. The arrangement of these tubes is shown in detail at 2, the curved tube being the overflow, the straight one the inlet. To the inlet and overflow tubes is fitted a valve consisting of a metal ball or a marble. The fitting is accomplished by simply driving the ball against the end of each tube, so as to form valve seats. Four wires are inserted in the stopper around the inlet tube to prevent the escape of the valve. The distance which should separate these tubes as well as the weight of the ball valve is determined by experiment.

In the air chamber above the branch of the supply tube is confined a ball valve by a cage formed of wires inserted in the stopper as shown at 3. This valve is fitted in the manner already described.

The discharge tube extends above the level of the reservoir. The reservoir and the tubes are supported by wire loops and standards inserted in a base board.

Water flows from the reservoir through the valve chamber and out at the overflow. When the velocity of the flow is sufficient to carry the valve in the valve chamber up against the end of the curved overflow tube, the overflow is immediately checked and the momentum acquired by the water causes it to continue to flow for an instant into the air chamber, compressing the air in the chamber, and causing the water to rise in the discharge tube. As soon as equilibrium is established, the valve in the air chamber closes and the valve in the valve chamber falls away from its seat on the overflow tube, allowing the water to discharge again, and so on, this intermittent action continuing so long as there is water in the reservoir. The water discharged by the riser is only a fraction of that flowing out of the reservoir.

Emmensite.

The new explosive emmensite, which is now attracting considerable attention, is prepared, says *Engineering*, by dissolving at a moderate temperature an excess of picric acid in nitric acid of a density of from 50° to 60° Baume; an operation which can be performed without danger if the temperature is kept low. On evaporating the liquid afterward, fine rhombic crystals of a bright yellow color are first deposited, which are followed by others of a lighter hue, and finally by a precipitate of a light gray color, the whole of these three being probably isomers, though their composition has not as yet been determined with accuracy. It has, however, been recognized that they contain more hydrogen than picric acid, and a quantity of oxygen insufficient for complete combustion.

To provide this missing quantity, Dr. Emmens, the inventor of the explosive, employs ammonium nitrate, the mixture being effected by melting together five parts, by weight, of the above crystals with five parts of ammonium nitrate over a paraffine bath. When completely fused, six parts of picric acid are added and thoroughly incorporated, after which the whole is poured out into suitable moulds. These operations involve no danger if the temperature is kept below 200° Cent. Thus prepared, emmensite is an amorphous solid of a bright yellow color, completely odorless, but having a bitter taste. It has a spongy texture, and its specific gravity is 1·7. Microscopic examination tends to confirm the opinion that it is a chemical compound, and not a mere mixture. The explosive is made in several degrees of strength, some of the qualities resembling dynamite, while others can be used for firearms. It is but slightly sensitive to shock, and No. 1 emmensite can be heated without exploding, but Nos. 3 and 4 detonate slightly when raised to a high temperature.

The Fashionable Wood of the Season.

Oak finished antique will be as much used as ever in the manufacture of furniture next year. It is the most popular of all the woods, and the demand for it is steady, and no signs of a change in popular favor are apparent. Walnut is nowhere in the race with oak for popularity, and furniture of that richest of all materials, especially for the bedroom, boudoir, and dining room, remains in the warerooms uncalled for and in no demand. Mahogany is used now, as it always was and will be, for the finest goods, and cherry takes a high rank, but oak stands first in favor and will continue in the front rank for another year at least, and probably much longer, as there is nothing to take its place. For the cheaper grades of furniture, ash, maple, birch, and these woods, with various stains and finishes, continue, as they always will, in favor.

A Remarkable Meteor.

At Oswego, N. Y., on the night of January 26, a large and brilliant meteor was seen. It appeared in the southern sky about ten minutes past 9, 25 degrees above the horizon. It seemed about twice the brilliancy of Venus. It moved horizontally from west to east with the apparent speed of a rocket. It grew in size as it moved, and in the southwest broke into three balls, each larger than the whole when first seen. Just before breaking it showed a red tinge, and after separation each part showed vivid green like the characteristic flame of copper.

RECENTLY PATENTED INVENTIONS.

Engineering.

THROTTLE VALVE.—John Tonge, Minneapolis, Minn. This is a valve formed of two parts connected together by an adjustable connection, so that when used as a throttle valve on a locomotive, a spring allows one-half of the valve to yield when the slide valve is reversed, allowing the valve to act as a relief valve to the steam chest at the moment of reversal of the link.

TRANSMITTING POWER.—Timothy W. Lemieux, Duluth, Minn. This is a device especially adapted for cable railways, as a means for reversing the moving direction of the car, while also acting as a simple and positive grip, one movement of an adjusting lever releasing a brake from one band wheel and applying it to the other band wheel, which may be effected either gradually or suddenly.

COVERING FOR BOILERS, ETC.—William H. Suhr, New York City. This covering is also adapted for steam or water pipes, or as a non-conductor on hot or cold surfaces, having an inner wall of fireproof material, gauze and waterproof material, and an outer wall for similar purpose, with a filling of mineral or like material, the invention being an improvement on a former patented invention of the same inventor.

Mechanical.

BRICK PRESS.—James H. Steele, Butte City, Montana Ter. Attached to the frame of the press is a steam pipe with perforations for diverting jets of steam into the mould, to prevent the clay from sticking, the moulds being vertically reciprocating and having openings at one side, in combination with vertically reciprocating followers.

REVERSING GEAR.—Samuel J. White, Bearden, Ark. A shifting pulley is arranged parallel to a metal disk having flat sides, the pulley having a laterally projecting annular flange and friction ring, to bear against the side of the disk when the pulley is shifted, with other novel features, the device being adapted for use with sawmill feeds and other reciprocating mechanism.

DRIVING MECHANISM. — Thomas L. Butler, Blackstone, Mass. This invention provides for rotating the spindles of a spinning machine, each spindle having two whirls and a single continuous belt passing around both whirls of each spindle and a pair of grooved driving drums, each having several parallel grooves, around which the belt passes sufficiently to transmit through a single belt by friction the power necessary to drive all the spindles.

Railway Appliances.

STATION INDICATOR.—Julius Tullius, New York City. Curtain-carrying drums on which the names of stations are printed are journaled in a casing secured near the car roof, and having eight openings, the drums being manipulated by a rotary shaft journaled in the ends of the car, and having a pull bar within convenient reach of the conductor or brakeman, whereby the curtain drums may be made to display the names of the various stations.

HOSE PIPE COUPLING.—David Hennessy, New York City. This coupling is especially adapted for railroad cars, to form a continuous pipe connection, and is a peculiar construction of hooking and unhooking coupling, which may be automatic in its closing action, forming a perfect closing joint and secure lock, while readily unfastening itself in case of derailment of a car or the breaking up of a train.

STREET CAR MOTOR. — Burchell R. Moore and Charles D. Montanye, Kansas City, Kansas. This is a motor adapted to be operated by a gas engine to propel a street car, a friction wheel mounted on a shaft revolving in bearings on the car bottom communicating motion to another friction wheel on the car axle, and the invention covering various novel features.

Miscellaneous.

LEVELING INSTRUMENT.—Charles A. Karr, Green Elm, Kansas. This is an improved hydrostatic leveling instrument designed to be simple and durable, compact in form, and easily adapted for a wide range of work, the invention being an improvement on a former patented invention of the same inventor.

FILTER PUMP.—Orson H. Woodworth, Columbia City, Ind. The filter is connected both with the bore of the pump and with the spout, valves being provided to direct the water either into the filter or to the spout, whereby water may be filtered by the act of pumping it from the well, cistern, or other source of supply, or unfiltered water may be readily drawn when desired.

ROAD GRADER.—James M. Holland, Mount Pleasant, Iowa. This is a machine of simple construction, wherein the scraping blade may be adjusted to any desired angle, being so mounted that it will be automatically raised from the ground to a position to allow the front wheels to pass beneath the supporting frame when the vehicle is turned sharply around.

WINDOW VENTILATOR. — Alfred C. Stevenson, Oakdale Station, Pa. Combined with the window frame are two spring rollers provided with perforated diaphragms arranged to be pulled down across the opening of the sash to form a space between, with a support arranged between the diaphragms to receive volatile substances for modifying the air admitted, with other novel features.

PHOTOGRAPHIC CAMERA. — John J. Higgins, New York City. (Two patents.) These inventions cover novel lens-carrying and focusing devices, with shutter and mechanism for operating it, the finder, and means for controlling the opening and closing of the lens aperture in relation with the opening and closing of the exposing aperture of the finder, the whole instrument being so constructed that it presents little or no mechanism on its exterior to attract especial attention as to its character, whereby it is particularly fitted for a detective camera; a lid or cover at the back of the camera body has special locking means, with swinging plate holder frame, the body of the instrument affording special facilities for storing away in a compact manner additional plate holders out of the line of vision or field of view.

VEHICLE SPRING. — Edwin Jarrell, Harper, Kansas. This invention covers novel features of construction and combinations of parts designed to furnish a neat, light, and durable torsion spring which will support the occupants of a vehicle easily, and by which pitching and rocking of the vehicle will be avoided.

BARREL.—Isaac J. W. Adams, Laurel, Del. This barrel is formed of two or more layers of splints crossing each other diagonally, the splints being securely nailed to each other and to supporting hoops, making a strong barrel, in which the material carried will be thoroughly ventilated.

MUSIC LEAF TURNER. — Frank H. Loughlin, Syracuse, N. Y. This invention covers a device designed to be readily attached to or detached from a musical instrument or music stand, whereby the leaves of sheet music may be independently turned expeditiously and conveniently.

POCKET BOOK FASTENING.—Louis B. Prahar, Brooklyn, N. Y. This device is also designed for use with purse or satchel frames, and consists essentially of a two part frame, a spring strip being secured at each end to one of the frame members and arranged to engage the other frame member.

BURIAL APPARATUS.—George L. Gehring, Rapid City, Dakota Ter. This invention is designed to furnish a bier of simple construction adapted to receive a coffin, and capable of propulsion, so that, when the device is located over the grave, the coffin may be readily lowered by the undertaker or his assistant.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

NEW BOOKS AND PUBLICATIONS.

The Century Magazine for March has its usual variety of beautiful illustrations and interesting reading matter. George Kennan describes a visit to the Grand Lama of the Trans-Baikal. George De Kay gives some sketches touching the establishment of Christianity in Ireland, and M. G. Van Rensselaer has a richly illustrated article on York Cathedral, the views covering many different points of view, and being extremely fine specimens of engraving.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(406) N. D. asks: How is it that clouds float in the sky in winter, in the coldest weather, the mercury many degrees below zero? How is it that the vapors of which they consist are not condensed before they accumulate? In fact, they float far above the earth, where the temperature is much colder than at the surface. They remain for days suspended there. Is it by a miraculous interposition of Providence, or is it by some known natural cause? I should like to know about it. A. We can find nothing miraculous in the floating of clouds at any temperature. Clouds float for the same reason that dust floats, because of the smallness of the particles, whether liquid or frozen, that compose them. The clouds are constantly changing. We cannot say that the same cloud floats for any length of time.

(407) H. R. asks: 1. How are electric motors reversed? A. By having a duplicate set of brushes heading in the reverse direction; by shifting from one set to the other the motor is reversed. The position of the brushes on the commutator effects the direction of rotation. 2. How do you find the horse power of a motor? A. By testing its pull with a brake, and determining the number of rotations. From these data foot pounds are deduced, 33,000 of which per minute equal one horse power. 3. Can the motor described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641, be used as a dynamo, and if so, how many lights (16 candles) will it run? A. Any motor can be used as a dynamo; the one in question might supply one or two low voltage 16 C. P. lamps.

(408) W. C. G. asks for a receipt to be used on the hands and face that will keep off the mosquito and black fly that infest the North Woods during the fishing season. A. Mix sweet oil and oil of pennyroyal, or oil of pennyroyal and oil of tar. These are more or less efficacious.

(409) W. H. asks: What is the formula for making ink used for making duplicate copies with Edison mimeograph, also cyclostyle. A. Copying inks, for type writer and similar work in general, are made of aniline color dissolved in alcohol, thickened with glycerine and mixed with enough water to give proper consistency. The cyclostyle and mimeograph should be worked with fine printer's ink. Copying ink is not required, as they give many copies from one stencil.

(410) C. B. H. writes: Can I make paper caps, like those used in toy pistols, except that I want them to ignite without detonation, to ignite with the friction produced in piercing them with a pointed instrument roughened on the sides. A rough brad-awl for instance? Ignition to be instantaneous. A. Dissolve the composition off sulphur matches by heating in water, and when thick enough, use it on your paper, or try following formula; it will, we think, give good results: Gum arabic 6 parts, red phosphorus 9 parts, niter 14 parts, binoxide manganese 16 parts, water a sufficiency. It is dangerous to manipulate and should be heated over a water bath.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

February 12, 1889,

AND EACH BEARING THAT DATE.

(See note at end of list about copies of these patents.)

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Stoves and stoveware and furniture, Quick Meal Stove Company ... 16,272
Type, printers' rules, printers' leads, and other printers' furniture, Mather Manufacturing Co. 16,269
Whisky, C. E. Stutts & Co ... 16,275

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

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FORTY-FOURTH ANNUAL REPORT
OF THE
NEW YORK LIFE INSURANCE COMPANY
Office: Nos. 346 & 348 Broadway, New York.

JANUARY 1, 1889.

Amount of Net Assets, January 1, 1888.....$79,912,317.17

REVENUE ACCOUNT.

Premiums	$22,501,931.11	
Less deferred premiums, January 1, 1888	1,174,340.36—$21,127,590.75	
Interest and rents, etc	4,762,169.67	
Less interest accrued January 1, 1889	488,477.59—	4,273,692.08—$25,401,282.83
		$105,313,600.00

DISBURSEMENT ACCOUNT.

Losses by death, and Endowments matured and discounted (including reversionary additions to same)		$5,425,926.78
Dividends (including mortuary dividends), annuities, and purchased insurances		5,547,143.27
Total Paid Policy Holders	$10,973,070.05	
Taxes and re-insurances		321,062.84
Commissions (including advanced and commuted commissions), brokerages, agency expenses, physicians' fees, etc		3,558,440.80
Office and law expenses, salaries, advertising, printing, etc		654,690.12—$15,489,263.81
		$89,824,336.19

ASSETS.

Cash on deposit, on hand, and in transit		$3,695,836.94
United States Bonds and other bonds and stocks (market value, $58,222,751.94)		54,566,901.58
Real Estate		9,308,152.08
Bonds and Mortgages, first lien on real estate (buildings thereon insured for $15,800,000 and the policies assigned to the Company as additional collateral security)		16,906,932.50
Temporary Loans (market value of securities held as collateral, $2,144,630)		1,670,250.00
*Loans on existing policies (the Reserve on these policies, included in Liabilities, amounts to over $2,000,000)		378,874.10
*Quarterly and semi-annual premiums on existing policies, due subsequent to Jan. 1, 1889		1,435,734.86
*Premiums on existing policies in course of transmission and collection. (The Reserve on these policies, included in Liabilities, is estimated at $1,500,000)		1,045,089.46
Agents' balances		788,959.43
Accrued Interest on Investments, January 1, 1889		451,605.24—$89,824,336.19
Market value of securities over cost value on Company's books		3,655,850.36
		$93,480,186.55

* A detailed schedule of these items will accompany the usual annual report filed with the Insurance Department of the State of New York.

TOTAL ASSETS, JANUARY 1, 1889, - - - - - - $93,480,186.55

Appropriated as follows:

Approved losses in course of payment		$555,555 62
Reported losses awaiting proof, etc.		392,964.77
Matured endowments, due and unpaid (claims not presented)		50,511 98
Annuities due and unpaid (claims not presented)		36 955 00
Reserved for re-insurance on existing policies, at the Actuaries' table 4 per cent interest		78,985,757.00
Reserved for contingent liabilities to Tontine Dividend Fund, January 1, 1888, over and above a 4 per cent Reserve on existing Policies of that class	$5,315,720.83	
Addition to the Fund during 1888	2,045,665 84	
	$7,359,386.67	
DEDUCT—Returned to Tontine policy-holders during the year on matured Tontines	935,609.54	
Balance of Tontine Fund January 1, 1889		6,423,777.13
Reserved for premiums paid in advance		46,504.21
		$86,397,936.30
Divisible Surplus (Company's New Standard)		7,082,250.35
		$93,480,186.55
Surplus by the New York State Standard (including the Tontine Fund)		13,500,000.00

From the undivided surplus, as above, the Board of Trustees have declared a Reversionary dividend to participating policies in proportion to their contribution to surplus, available on settlement of next annual premium.

Returns to Policy-holders.		Insurance in Force.		Assets.		New Policies Issued.	
1886	$7,027,230	Jan. 1, 1887	$304,373,540	Jan. 1, 1887	$75,421,453	1886	22,027
1887	9,535,210	Jan. 1, 1888	358,935,536	Jan. 1, 1888	83,079,845	1887	28,522
1888	10,973,070	Jan. 1, 1889	419,886,505	Jan. 1, 1889	93,480,186	1888	33,334

Number of Policies issued during the year, 33,334. Risks assumed, $125,019,731.

Total number of policies in force January 1, 1889, 129,911. Amount at risk, $419,886,505.

TRUSTEES:

WILLIAM H. APPLETON,	JOHN CLAFLIN,	WALTER H. LEWIS,	JOHN N. STEARNS,	HENRY TUCK,
WILLIAM H. BEERS,	ROBERT B. COLLINS,	EDWARD MARTIN,	WM. L. STRONG,	A. H. WELCH,
WILLIAM A. BOOTH,	ALEX. STUDWELL,	RICHARD MUSER,	W. F. BUCKLEY,	L. L. WHITE.
HENRY BOWERS,	ELIAS S. HIGGINS,	C. C. BALDWIN,		

THEODORE M. BANTA, Cashier.
A. HUNTINGTON, M.D., Medical Director.

WILLIAM H. BEERS, President.
HENRY TUCK, Vice-President.
ARCHIBALD H. WELCH, 2d Vice-President.
RUFUS W. WEEKS, Actuary.

Construction of Breakwater at Glen Cove Harbor, N. Y.—Engineer Office, U. S. Army, Room 57, Army Building, corner Houston and Greene Streets, New York, February 11, 1889.—Sealed proposals in triplicate for Construction of a Breakwater at Glen Cove Harbor, N. Y., will be received at this office until twelve (12) o'clock noon, on Wednesday, March 13, 1889. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. Further information can be obtained at this office.
D. C. HOUSTON, *Lieut.-Colonel of Engineers.*

Hire of Dredging Plant for Improving Housatonic River, Conn.—Engineer Office, U. S. Army, Room 57, Army Building, corner Houston and Greene Streets, New York, February 11, 1889.—Sealed proposals in triplicate for Hire of Dredging Plant for Improving Housatonic River, Conn., will be received at this office until twelve (12) o'clock noon, on Wednesday, March 13, 1889. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, Vol. 23, page 332, and Vol. 24, page 414, Statutes at Large. Further information can be obtained at this office.
D. C. HOUSTON, *Lieut.-Colonel of Engineers.*

TRAMWAY, COMPRESSED AIR.—DESCRIPTION of a Tramway recently constructed between Vincennes and Ville Evrard, and the rolling stock of which is propelled by a mixture of compressed air and steam. With 2 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 637. Price 10 cents. To be had at this office and from all newsdealers.

LIMITING NUMBERS OF TEETH IN Gear Wheels.—A valuable paper by George B. Grant treating of the different methods of determining the limiting numbers of teeth in gear wheels when small pinions must be used. The cycloidal system. The interchangeable volute system. The non-interchangeable volute system. Unreversible teeth. With 11 figures. Contained in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 592. Price 10 cents. To be had at this office and from all newsdealers.

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Send for free illustrated Catalogue.

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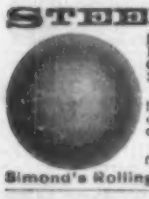

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Samples and prices on application.

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Morocco covered Camera, in handsome sole-leather case, loaded for 100 pictures.

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Send for copy of Kodak Primer with Kodak Photograph.

INVENTORS and others desiring new articles manufactured and introduced, address P. O. Box 95, Cleveland, O.

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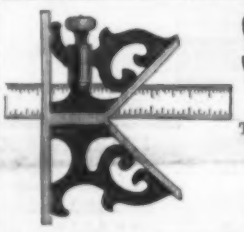

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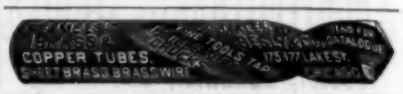

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